Exhibit A

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(54) **METHODS AND SYSTEMS FOR DISTRIBUTING INTERACTIVE CONTENT**

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H04N 21/2668	(2011.01)

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(57) **ABSTRACT**

Aspects of the present invention relate to methods and systems for controlling the distribution of supplementary content by generating a first control signal when known content is initially detected in a broadcast stream, and after generating the first control signal, generating a second control signal when the detected content is no longer detected in the broadcast stream. The first and second control signals may be used to control the distribution of supplementary content.

17 Claims, 13 Drawing Sheets

Episode A:

Intro	S2a	S3a	S4a	S5a	S6a	S7a	S8a	S9a

602

Episode B:

Intro	S2b	S3b	S4b	S5b	S6b	S7b	S8b

604

As broadcast:

902

Intro	S2a	C1	S3a	S4a	C2	S5a	S6a	C3	S7a	C4	S8a	S9a

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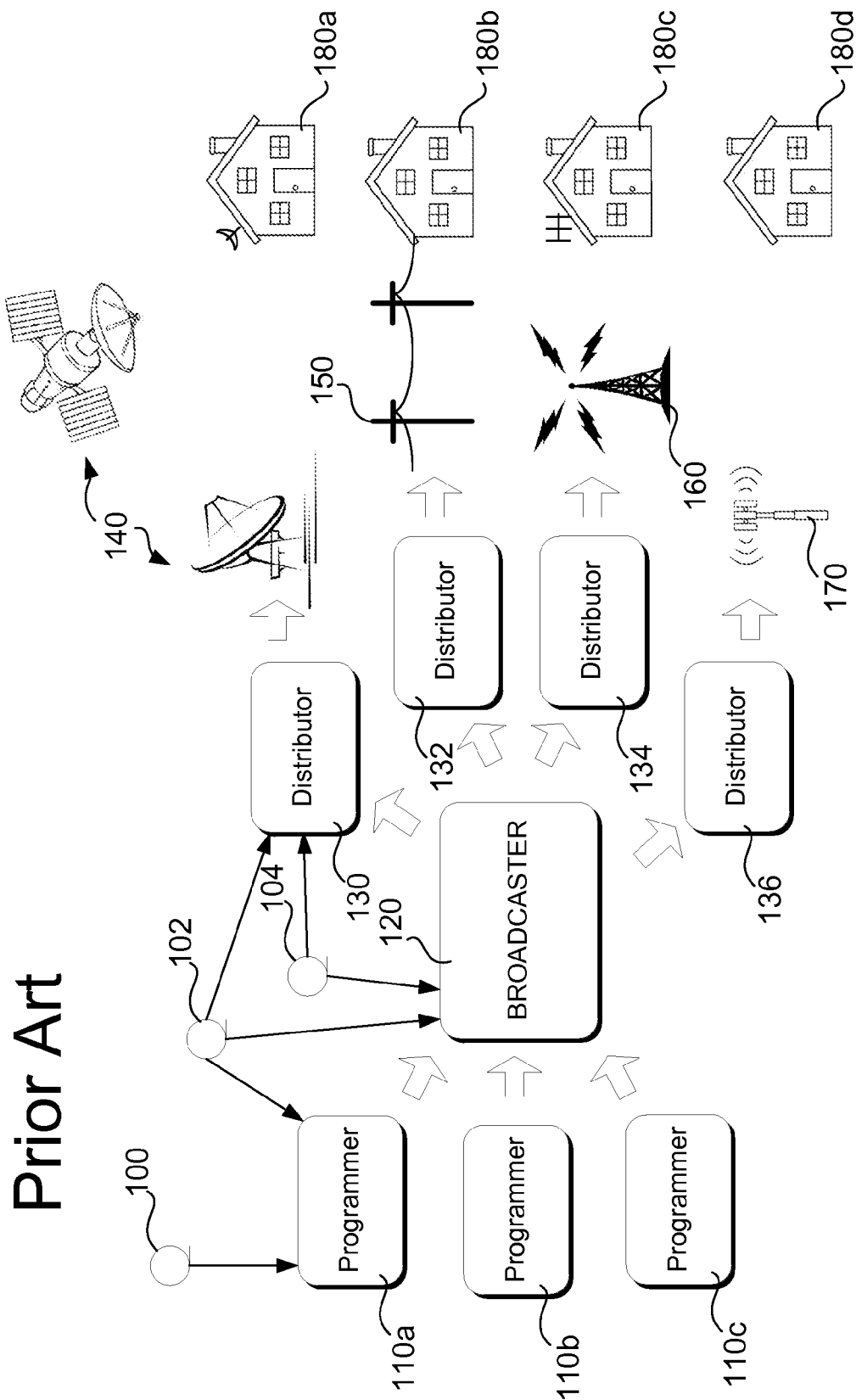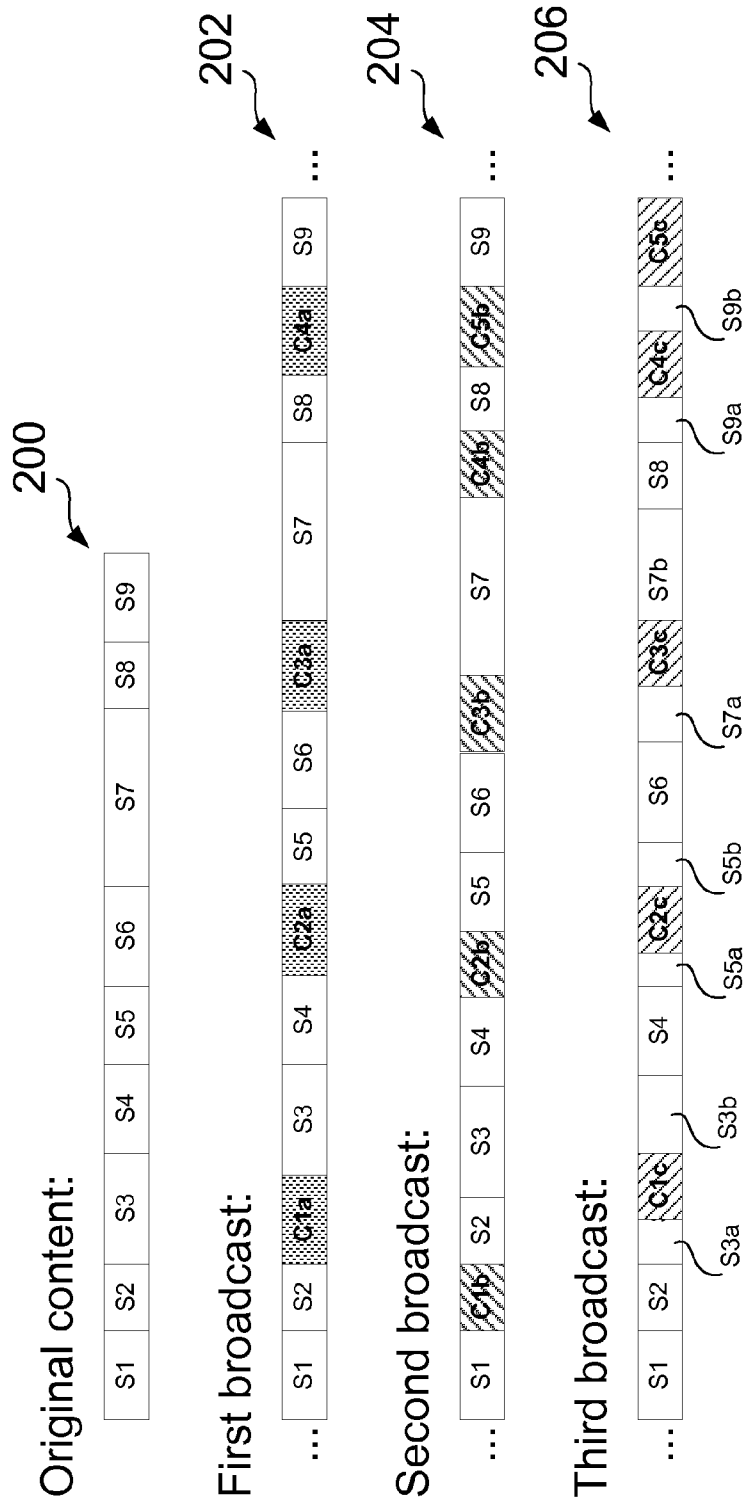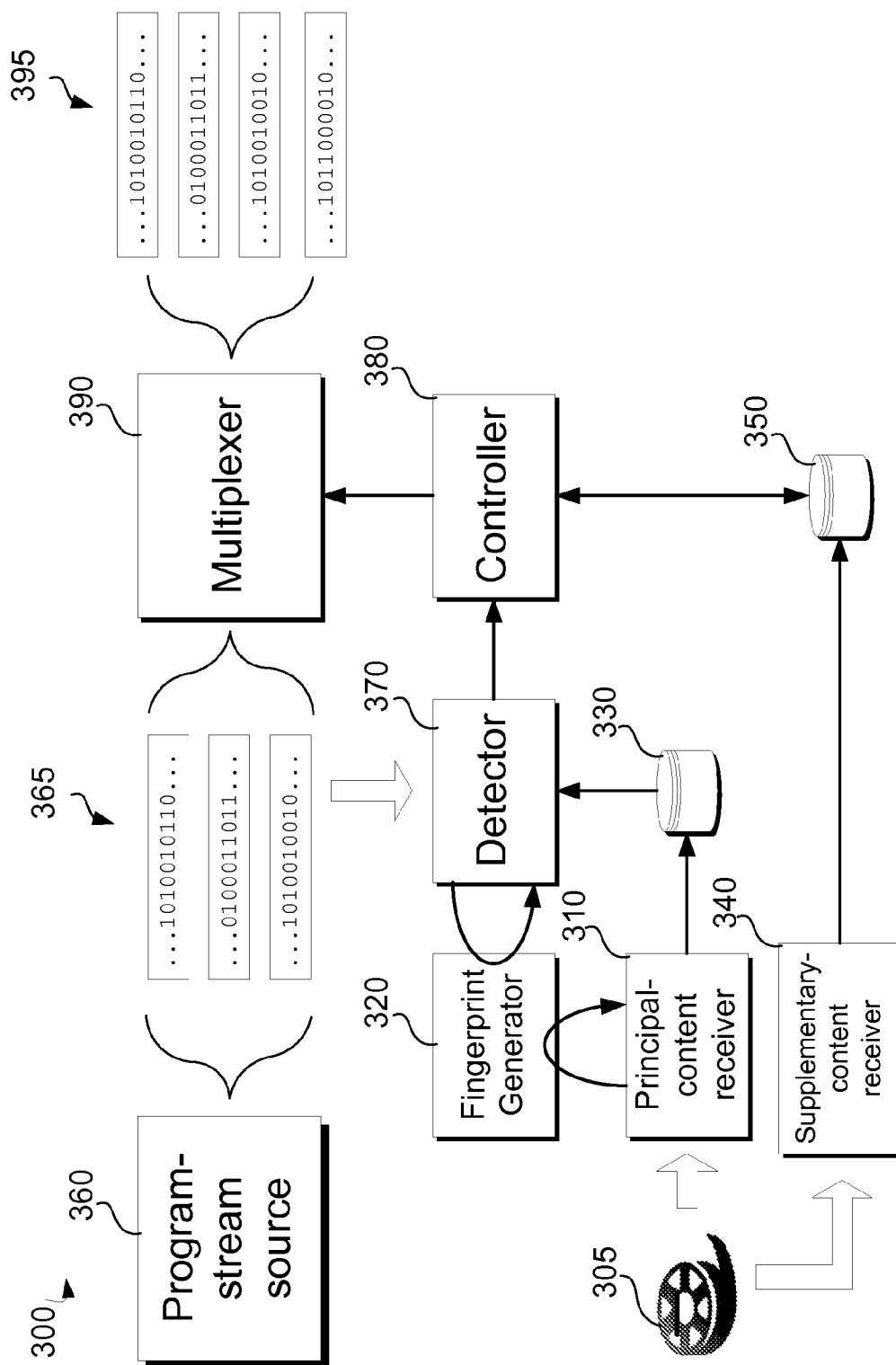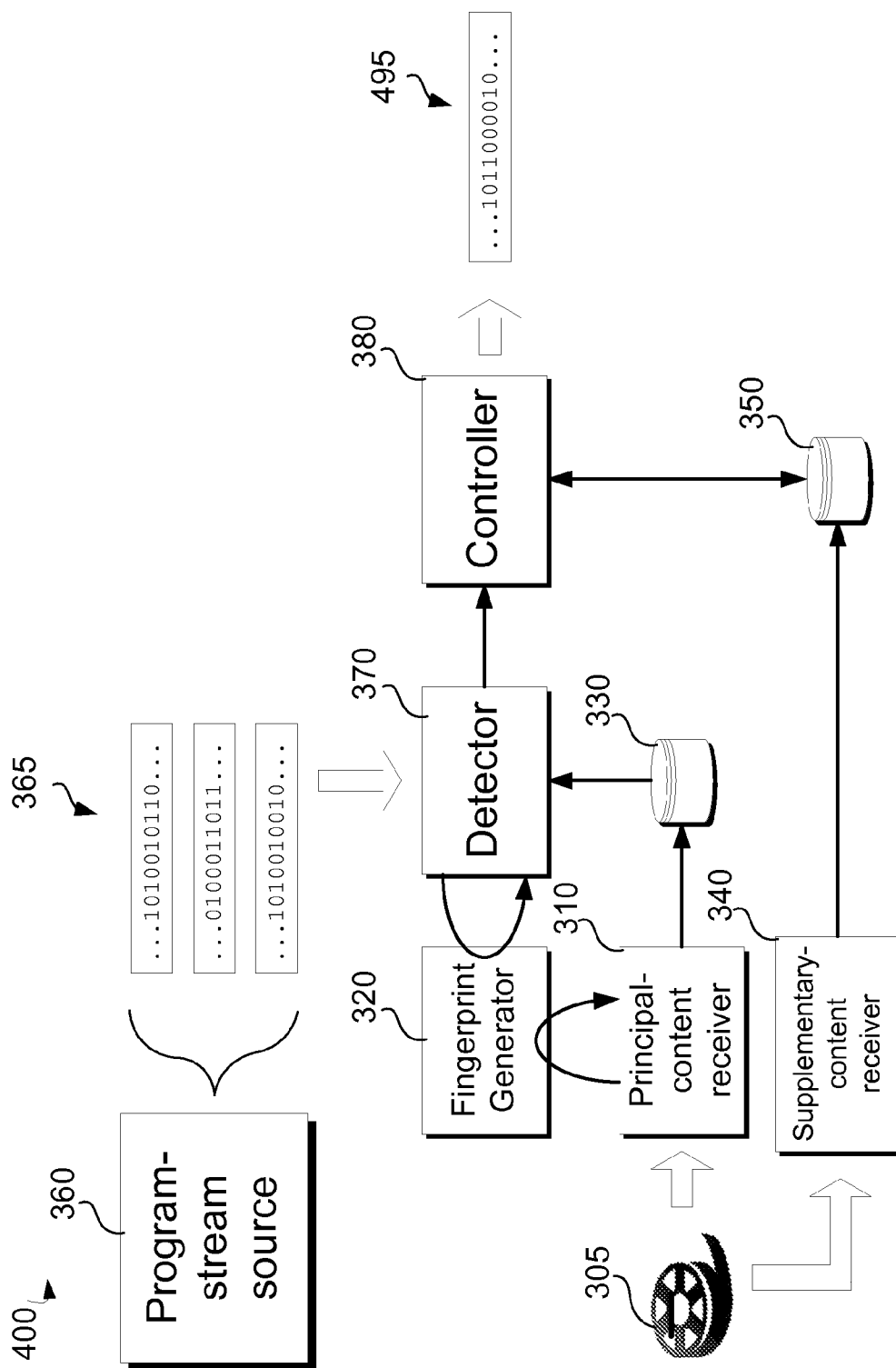
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Prior Art

FIG. 1

Prior Art

FIG. 2

FIG. 3

FIG. 4

FIG. 5

Episode A: 602

| Intro | S2a | S3a | S4a | S5a | S6a | S7a | S8a | S9a |

Episode B: 604

| Intro | S2b | S3b | S4b | S5b | S6b | S7b | S8b |

Episode C: 606

| Intro | S2c | S3c | S4c | S5c | S6c | S7c | S8c | S9c | S10c |

FIG. 6

700

F ⟩ ┈┈➤ **Initialize detection module** ⟍702

Clear match identifier, offset and counter ⟍704

Sample stream, generate fingerprint ⟍706

Compare fingerprint with reference fingerprints ⟍708

No ○⟍712

Unambiguous match found? ⟍710   722⟍○ No

Yes ○⟍714

716⟍ **Previous match?**   718 ○ No

No ○⟍734   720 **Valid offset?**

Yes ○⟍730   Yes ○⟍724

732⟍ **Match with valid offset?**   **Set match identifier** ⟍726

Yes ○⟍736

No ○⟍740 **Set match offset, increment match counter** ⟍728

738⟍ **Equal to limit?**   742 ○ ⟩ A

Yes

FIG. 7a

700

```
 ┌───┐     ┌───────────────────────────┐
 │ A ├───▶ │ Generate first control signal │ ──744
 └───┘     └───────────────────────────┘
                        │
                        ▼
           ┌───────────────────────────┐
           │     Reset error counter     │ ──746
           └───────────────────────────┘
                        │
                        ▼
 ┌───┐     ┌───────────────────────────┐
 │ E ├───▶ │      Sample stream,         │ ──748
 └───┘     │   generate fingerprint      │
           └───────────────────────────┘
                        │
                        ▼
           ┌───────────────────────────┐
           │   Compare fingerprint with   │ ──750
           │    reference fingerprints    │
           └───────────────────────────┘
                        │
                        ▼
        752      ◇ Match              758
              ◇ with stored ◇────No────▶ │ C │
              ◇ identifier? ◇
                        │
                      Yes ──754
                        │
                        ▼
        756       ◇ Valid              766
              ◇   offset?   ◇────No────▶ │ D │
                        │
                      Yes ──762
                        │
                        ▼
           ┌───────────────────────────┐
           │      Store match offset      │ ──764
           └───────────────────────────┘
```

FIG. 7b

700

C

760 — Match to other content?

770

No

Match lost?

774

No — E

772

Yes ○—780

D

Increment error counter

768

782 — Error count > limit?

784

No — E

Yes ○—786

Yes ○—776

Generate second control signal

778

F

FIG. 7c

FIG. 8

FIG. 9

Episode B:

| Intro | S2b | S3b | S4b | S5b | S6b | S7b | S8b |

604

As broadcast:

| Intro | S2a | C1 | S3a | S4a | C2 | S5a | S6a | C3 | S7a | C4 | S8a | S9a |

1002

FIG. 10

FIG. 11

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METHODS AND SYSTEMS FOR DISTRIBUTING INTERACTIVE CONTENT

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of U.S. patent application Ser. No. 13/874,268, entitled "Methods and Systems for Distributing Interactive Content," filed on Apr. 30, 2013, invented by Aslam Khader, Larry Alan Westerman and Mark-Andrew Ray Tait, said application, U.S. patent application Ser. No. 13/874,268, is hereby incorporated by reference herein, in its entirety.

FIELD OF THE INVENTION

Embodiments of the present invention relate generally to methods and systems for the distribution of interactive content in a broadcast stream and, in particular, to methods and systems for distributing interactive content using a content fingerprint.

BACKGROUND OF THE INVENTION

An ability to provide viewer-selectable interactivity in conjunction with audio-video content may be a desirable capability in a broadcast-television system. A required capability in a system intended for this purpose may be an ability to control interactivity during discontinuities in program content, for example, commercial breaks, emergency broadcast interruptions, and other program-content discontinuities. Existing systems for providing viewer-selectable interactivity in conjunction with audio-video content may be problematic in many broadcast environments because of existing systems' reliance on specific signaling content in the broadcast stream. No standardized method for conveying such signals is provided across the multiple broadcast methodologies, for example, cable, terrestrial, satellite, Internet Protocol, and other broadcast methodologies, that may be used to distribute program content. Furthermore, signals that are introduced into a broadcast stream at one point in a distribution chain may be modified or removed at a later point in the processing of the broadcast stream prior to reception by the viewer. Additionally, the insertion of commercial content into program content may vary with respect to the timing, duration and identity of the commercial content during each unique broadcast of a particular piece of program content and for each method of broadcast of the program content. Due to this variability, existing systems may require control signals be inserted specifically for each presentation of the program content.

Methods and systems that control the distribution of interactive content in a broadcast-television environment by recognizing program content in the broadcast stream in the absence of specific control signals in the broadcast stream; inserting appropriate supplementary content into the broadcast stream when program content is recognized; and ceasing to insert supplementary content in the broadcast stream when program content is interrupted may be desirable.

SUMMARY OF THE INVENTION

Embodiments of the present invention relate to systems and methods for controlling the distribution of supplementary content, in a broadcast system, by receiving a media content comprising at least one of an audio content and a video content and receiving supplementary content associ-

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ated with the received media content; and in a broadcast system, monitoring a broadcast stream; in the broadcast system, detecting either one of the at least one of the audio content and the video content of the media content in the broadcast stream; in the broadcast system, upon initially detecting either one of the at least one of the audio content and the video content of the media content, selecting supplementary content based on the detected media content, generating a first control signal, and using the first control signal to control the distribution of the selected supplementary content; and in the broadcast system, after generating a first control signal and upon failing to detect either one of the at least one of the audio content and the video content of the media content in the broadcast stream, generating a second control signal and using the second control signal to control the distribution of the selected supplementary content.

One aspect of the present invention teaches systems and methods for receiving media content comprising at least one of an audio content and a video content, receiving supplementary content associated with the media content, and assigning a unique identifier to the enhanced media content comprising the media content and the supplementary content.

Another aspect of the present invention teaches methods and systems for detecting content by creating a first database and storing in the first database a plurality of reference fingerprints generated from at least one of audio content and video content of the received media content, unique identifiers for the media content, and associations between the unique identifiers and the plurality of generated fingerprints; and when monitoring a broadcast stream, generating fingerprints from at least one of an audio content and a video content in the broadcast stream, comparing the generated fingerprints with the plurality reference fingerprints in the first database, and determining whether, or not, a match between a generated fingerprint and a reference fingerprint exists.

In a still further aspect of the present invention, the step of detecting content also includes finding a matching fingerprint in the first database and extracting the unique identifier associated with the matching fingerprint from the first database.

A still further aspect of the present invention teaches creating a second database and storing supplementary content, unique identifiers, and associations between the unique identifiers and the supplementary content in the second database; and upon detecting media content, determining the unique identifier of the detected media content, and using the unique identifier to extract supplementary content from the second database.

A still further aspect of the present invention teaches using the first control signal to control the distribution of the selected supplementary content by, upon generating the first control signal, inserting the supplementary content into the broadcast stream.

A still further aspect of the present invention teaches using the second control signal to control the distribution of the selected supplementary content by, upon generating the second control signal, ceasing to insert the supplementary content into the broadcast stream.

A still further aspect of the present invention teaches determining that a count of unambiguous matches for the initially detected either one of the at least one of an audio content and a video content, when compared to a reference database, meets a first criterion in relation to a first predefined limit and based on the count of unambiguous

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matches meeting the first criterion selecting supplementary content based on the detected media content.

A still further aspect of the present invention teaches determining an error count of match failures for the initially detected either one of the at least one of an audio content and a video content, when compared to a reference database, meets a second criterion in relation to a second predefined limit.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIG. **1** is a diagram of an exemplary system for distributing program content (prior art);

FIG. **2** is an exemplary schematic representation of multiple broadcasts of an episode of a television show (prior art);

FIG. **3** depicts an exemplary system for practicing an aspect of embodiments of the present invention;

FIG. **4** depicts an alternative embodiment of an exemplary system for practicing an aspect of embodiments of the present invention;

FIG. **5** depicts a flowchart of an exemplary process for monitoring a broadcast stream and generating control signals according to embodiments of the present invention;

FIG. **6** is a schematic representation of the content of three exemplary episodes of a television show;

FIGS. **7***a*, **7***b*, and **7***c* depict a flowchart of an exemplary process for monitoring a broadcast stream and generating control signals according to embodiments of the present invention;

FIG. **8** is a schematic representation of an exemplary broadcast of an episode of a television show;

FIG. **9** is a schematic representation of an exemplary broadcast of one of two episodes of a television show;

FIG. **10** is a schematic representation of an exemplary broadcast of one of two episodes of a television show; and

FIG. **11** is a schematic representation of an exemplary broadcast of an episode of a television show.

DETAILED DESCRIPTION OF THE INVENTION

By way of overview, embodiments of the present invention provide methods and systems for controlling the distribution of supplementary content by receiving a content comprising at least one of an audio content and a video content and receiving supplementary content associated with the media content; monitoring a broadcast stream; detecting the at least one of the audio content and the video content of the media content in the broadcast stream; upon initially detecting the media content, selecting supplementary content based on the detected media content, generating a first control signal, and using the first control signal to control the distribution of the selected supplementary content; and after generating a first control signal and upon failing to detect the media content in the broadcast stream, generating a second control signal and using the second control signal to control the distribution of the selected supplementary content.

A further embodiment of the present invention provides systems and methods for receiving media content comprising at least one of an audio content and a video content,

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receiving supplementary content associated with the media content, and assigning a unique identifier to the enhanced media content.

Yet a further embodiment of the present invention provides methods and systems for detecting content by creating a first database and storing in the first database a plurality of reference fingerprints generated from at least one of audio content and video content of received media content, unique identifiers for the media content, and associations between the unique identifiers and the generated plurality of reference fingerprints; and when monitoring a broadcast stream, generating fingerprints from at least one of the audio content and video content in the broadcast stream, comparing the generated fingerprints with the plurality of reference fingerprints in the first database, and determining whether, or not, a match between a generated fingerprint and a reference fingerprint exists.

Yet a further embodiment of the present invention provides methods and systems for detecting content that also includes the step of finding a matching reference fingerprint in the first database and extracting the unique identifier associated with the matching reference fingerprint from the first database.

Yet a further embodiment of the present invention provides methods and systems for detecting content that also includes the step of creating a second database and storing supplementary content, unique identifiers, and associations between the unique identifiers and the supplementary content in the second database; and upon detecting media content, determining the unique identifier of the detected media content, and using the unique identifier to extract supplementary content from the second database.

Yet a further embodiment of the present invention provides methods and systems for controlling the distribution of supplementary content that also includes the step of using the first control signal to control the distribution of the selected supplementary content by, upon generating the first control signal, inserting the supplementary content into the broadcast stream.

Yet a further embodiment of the present invention provides methods and systems for controlling the distribution of supplementary content that also includes the step of using the second control signal to control the distribution of the selected supplementary content by, upon generating the second control signal, ceasing to insert the supplementary content from the broadcast stream.

As used herein, the term "program" refers to a body of audio content and/or video content intended to be consumed by a viewer as a unified entity for entertainment, diversion, information, education or other viewer-related purposes. Program content may be produced by a "programmer," for example, an individual, a group, a commercial company, a non-profit organization, or other program-content-production entity. A "series" is a set of programs that share common thematic, stylistic, and/or structure elements, and are intended to be consumed as an artistic whole. Each of the set of programs in a series is an "episode" of the series.

As used herein, the phrase "secondary content" refers to non-program audio and/or video content, for example, advertisements, news items, public service announcements, station identification spots and other non-program content. In a broadcast system, program content may be presented in a discontinuous fashion with various elements of secondary content interleaved within the program content.

As used herein, the phrase "supplementary content" refers to at least one of audio, video, still images, text, executable code, and other data intended for distribution and consump-

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tion with primary content, for example, program content or secondary content. Supplementary content may be associated with program content or with secondary content.

As used herein, the phrase "media content" refers to program content or secondary content.

As used herein, the phrase "program stream" refers to a sequence of analog or digital data comprising program and secondary content, and possibly including supplementary content.

As used herein, the phrase "broadcast stream" refers to an aggregation of one or more program streams.

As used herein, the terms "broadcast" and "broadcasting" refer to the process of aggregating program content, secondary content, and possibly supplementary content into at least one program stream, aggregating one or more program streams into a broadcast stream, and delivering the broadcast stream to one or more entities. Elements of program, secondary, and supplementary content may be inserted, removed, modified, or replaced during the generation and manipulation of a program stream. A "broadcaster" is an entity that operates a broadcast system.

As used herein, the terms "distribute" and "distribution" refer to the process of delivering a broadcast stream to viewers through a physical delivery network. The physical delivery network may utilize wired, wireless, or a combination of wired and wireless means. A "distributor" is an entity that operates a distribution system. A broadcast stream may be modified during distribution by inserting, removing, modifying or replacing elements of one or more program stream within the broadcast stream.

As used herein, the terms "interactive" and "interactivity" refer to the capability in a viewing environment for a viewer to control the presentation of program, secondary, and/or supplementary content through direct or indirect manipulation of an interface through a remote control, mouse, keyboard, touch panel, movement recognition camera, microphone and other interface mechanisms.

As used herein, the term "fingerprint" refers to a value or set of values computed as a condensed mathematical representation of the signal content for some subset of the video and/or audio content of a program.

The various aspects of the claimed subject matter are now described with reference to the annexed drawings. It should be understood, however, that the drawings and detailed description relating thereto are not intended to limit the claimed subject matter to the particular form disclosed. Rather, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the claimed subject matter.

Furthermore, the disclosed subject matter may be implemented as a system, method, apparatus, or article of manufacture using standard programming and/or engineering techniques to produce software, firmware, hardware, or any combination thereof to control a computer or processor based device to implement aspects detailed herein. The term "article of manufacture" as used herein is intended to encompass a computer application accessible from any computer-readable device, carrier, or media. Additionally it should be appreciated that a carrier wave can be employed to carry computer-readable electronic data such as those used in transmitting and receiving electronic mail or in accessing a network such as the Internet or a local area network. Of course, those skilled in the art will recognize many modifications may be made to this configuration without departing from the spirit and scope of the claimed subject matter.

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The term "computer" is used herein to refer to any device with processing capability such that it can execute instructions. Those skilled in the art will realize that such processing capabilities are incorporated into many different devices and therefore the term "computer" includes PCs, servers, mobile telephone, tablet computers, personal digital assistants and many other devices.

The steps of the flowcharts described herein may be performed by software executing on hardware, by specialized hardware systems, or by a combination of software and specialized hardware. Certain steps of the flowcharts may be amenable to manual performance, but in general the flowcharts represent processes or operations that require hardware systems for their realization.

The methods described herein may be performed by software in machine readable form on a storage medium. The software can be suitable for execution on a parallel processor or a serial processor such that the method steps may be carried out in any suitable order, or simultaneously.

The description acknowledges that software can be a valuable, separately tradable commodity. The description is intended to encompass software, which runs on or controls 'dumb' or standard hardware, to carry out the desired functions. It is also intended to encompass software which 'describes' or defines the configuration of hardware, such as HDL (hardware description language) software, as is used for designing silicon chips, or for configuring universal programmable chips, to carry out desired functions.

The steps of the methods described herein may be carried out in any suitable order, or simultaneously where appropriate. Aspects of any of the examples described herein may be combined with aspects of any of the other examples described to form further examples without losing the effect sought.

Embodiments of the present invention will be best understood by reference to the drawings, wherein like parts are designated by like numerals throughout. The figures listed above are expressly incorporated as part of this detailed description.

It will be readily understood that the components of the present invention, as generally described and illustrated in the figures herein, could be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of the embodiments of the methods, systems and apparatus of the present invention is not intended to limit the scope of the invention, but it is merely representative of the presently preferred embodiments of the invention.

Elements of embodiments of the present invention may be embodied in hardware, firmware and/or a non-transitory computer program product comprising a computer-readable storage medium having instructions stored thereon/in which may be used to program a computing system. While exemplary embodiments revealed herein may only describe one of these forms, it is to be understood that one skilled in the art would be able to effectuate these elements in any of these forms while resting within the scope of the present invention. Exemplary computer-readable storage media may include, but are not limited to, flash memory devices, disk storage media, for example, floppy disks, optical disks, magneto-optical disks, Digital Versatile Discs (DVDs), Compact Discs (CDs), micro-drives and other disk storage media, Read-Only Memory (ROMs), Programmable Read-Only Memory (PROMs), Erasable Programmable Read-Only Memory (EPROMS), Electrically Erasable Programmable Read-Only Memory (EEPROMs), Random-Access Memory (RAMS), Video Random-Access Memory

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(VRAMs), Dynamic Random-Access Memory (DRAMs), and any type of media or device suitable for storing instructions and/or data.

Although the charts and diagrams in the figures may show a specific order of execution, it is understood that the order of execution may differ from that which is depicted. For example, the order of execution of the blocks may be changed relative to the shown order. Also, as a further example, two or more blocks shown in succession in a figure may be executed concurrently, or with partial concurrence. It is understood by those with ordinary skill in the art that a non-transitory computer program product comprising a computer-readable storage medium having instructions stored thereon/in which may be used to program a computing system, hardware and/or firmware may be created by one of ordinary skill in the art to carry out the various logical functions described herein.

FIG. 1 depicts an exemplary view of the prior art for distributing program content. Program content 100 may be created or acquired by one or more programmers (three shown) 110a, 110b, 110c. Supplementary content 102 may also be created or acquired by one or more programmers 110a, 110b, 110c. Programmers 110a, 110b, 110c may provide content 100 to one or more broadcasters (one shown) 120. A programmer 110a, 110b, 110c may provide program content to one or to more than one broadcaster (one shown) 120. A broadcaster 120 may aggregate program content 100. A broadcaster 120 may also acquire or create supplementary content 102 for association with program content 100. A broadcaster 120 may also acquire or create secondary content 104 for broadcast with program content 100 and supplementary content 102. A broadcaster 120 may create one or more program streams by aggregating and interleaving program content 100, supplementary content 102, and secondary content 104. A broadcaster 120 may deliver program streams to one or more distributors (four shown) 130, 132, 134, 136. A broadcaster 120 may delivery any given program stream to one or to more than one distributor (four shown) 130, 132, 134, 136.

A distributor 130, 132, 134, 136 may receive program streams from one or from more than one broadcaster (one shown) 120. A distributor 130, 132, 134, 136 may aggregate multiple program streams for broadcast distribution to viewers. A distributor 130 may also receive supplementary content 102 and secondary content 104 from one or more sources, and may insert, replace, modify, or remove supplementary content 102 and secondary content 104 in a program stream prior to broadcast distribution.

A distributor 130, 132, 134, 136 may utilize one or more physical distribution methods and systems. In this example, distributor 130 utilizes satellite system 140 to distribute broadcast content to a viewer household 180a. Distributor 132 utilizes cable system 150 to distribute broadcast content to a viewer household 180b. Distributor 134 uses terrestrial broadcast antenna 160 to distribute broadcast content to a viewer household 180c. Distributor 136 uses wireless telephone system 170 to distribute broadcast content to a viewer household 180d. The illustrated distribution methods are exemplary, and are not intended to limit the variety or range of broadcast content-distribution methods. Any one household 180a, 180b, 180c, 180d may receive broadcast content through one or through more than one distribution systems. Distributors 130, 132, 134, 136 may also provide return path communication capabilities to households 180a, 180b, 180c, 180d that may utilize the same or different communication path as does the broadcast content-distribution system. For example, a satellite distributor 130 may utilize a wired or

wireless telephony system to provide return path communication to a household 180a.

FIG. 2 demonstrates an example of an issue that embodiments of the current invention address. The original content 200 of a program episode may consist of a series of scenes, here represented by content segments labeled S1 to S9. The scenes may be of varying length, and the total duration of the program content is less than the broadcast interval within which the program content is conveyed. For example, if an episode is intended to be shown within a 30 minute time slot, the program content of the episode may be 22 minutes in length. The remaining eight minutes of the broadcast time slot is occupied by secondary content, for example, advertisements, promotions, station identification, previews and other secondary content. The secondary content may be interleaved with segments of the program content.

In this example, the first broadcast 202 of the program content consists of the first two scenes S1, S2 of the program content, followed by an interstitial pod C1a that may comprise advertisements, promotions, public service announcements, news bulletins, station identification, and the like. The content of interstitial pods may be the same for every distributor that distributes the program content, or may be different for each distributor. Following interstitial pod C1a, scenes S3 and S4 of the program content are broadcast, followed by a second interstitial pod C2a. Following interstitial pod C2a, scenes S5 and S6 are broadcast, following by a third interstitial pod C3a. Following interstitial pod C3a, scenes S7 and S8 are broadcast, following by a fourth interstitial pod C4a. Following interstitial pod C4a, scene S9 is broadcast, completing the broadcast interval. For the first broadcast 202, the timing of the interstitials reflects the program scene boundaries. The duration of the interstitials varies among the interstitials over the course of the broadcast interval.

Further in the example depicted in FIG. 2, the second broadcast 204 of the program content consists of the first scene S1, followed by an interstitial pod C1b, followed by scenes S2, S3, and S4, followed by a second interstitial pod C2b, and so forth, as illustrated, to the end of the broadcast interval. While the timing of the interstitials in the second broadcast 204 reflects the program scene boundaries, the locations and durations of the interstitials differ between the first broadcast and the second broadcast.

Still further in the example depicted in FIG. 2, the third broadcast 206 of the program content consists of the first scene S1, followed by scene S2, followed by a portion of scene S3, denoted S3a, followed by a first interstitial pod C1c. The first interstitial pod C1c occurs during a scene, and thus is not synchronized with the specific content structure of the program. Following interstitial pod C1c, the remainder of scene S3, denoted S3b, is broadcast, followed by scene S4, followed by a portion of scene S5, denoted S5a, followed by a second interstitial C2c and the remainder of scene S5, denoted S5b. This pattern is repeated, as illustrated, until the end of the broadcast interval. In this example third broadcast 204, the first four interstitials C1c, C2c, C3c, and C4c occur at regular intervals, irrespective of the scene structure of the original content, and a fifth interstitial C5c occurs at the end of the broadcast interval to fill the duration of the broadcast interval.

In FIG. 2 the patterning depicted in the various interstitials, dot-fill for the first broadcast 202, back cross-hatch for the second broadcast 204, forward cross-hatch for the third broadcast 206, is intended to emphasize the fact that the contents of a given interstitial, for example C1a, C1b, C1c, need not be the same from one broadcast interval to another.

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The particulars of the first interstitial C1a in the first broadcast 202 of the program content may bear no relationship to the particulars of the first interstitial C1b in the second broadcast 204 or the first interstitial C1c in the third broadcast 206 of the program content, whether in offset, duration, or content. The placement of interstitials may but need not respect the scene boundaries in the program content.

Consideration of the elements of FIG. 2 highlights an issue that arises in the broadcast of enhanced broadcast content. Enhanced broadcast content comprises original program content, plus supplementary content related to the program content, but distinct from it. Enhanced broadcast content may include interactive content intended to be displayed to and manipulated by the viewer. For a variety of reasons, including for example esthetics and contractual obligations, supplementary content related to the program content should not be visible or interactive to the viewer during interstitials in broadcast content. For example, consider an interactive program that displays trivia facts about the program content as the content is broadcast. When an interstitial occurs, the trivia facts should not be visible to the viewer, because the display of the trivia facts may obscure advertising content. To properly manage the broadcast of enhanced broadcast content, a system is required that can broadcast supplementary content during the presentation of program content and interrupt the broadcast of supplementary content during breaks or gaps in the broadcasting of the program content. The three broadcast scenarios depicted in schematic form in FIG. 2 demonstrate some of the problems that such a system must overcome. The location, duration, and content of gaps in program content may vary from one broadcast of a program to another. The location of the gaps may not be known at the time the program content is created. The location of gaps in a broadcast stream may but need not respect scene boundaries in program content In some modern systems, broadcast content may be transiently stored and manipulated, for example by removing or modifying portions of the broadcast content to allow the insertion of new interstitial materials subsequent to the creation of a broadcast stream; this manipulation may have the side effect of modifying the duration and relative offsets of scenes within program content. In all such cases, the precise content of a broadcast stream containing a particular episode of a series may not be known or predictable in advance. A system that, during a broadcast, can dynamically determine the beginning and end of program content, and the presence and duration of interstitial content, within a broadcast interval, may be desirable. The system may then use these determinations to control the distribution of supplementary content.

FIG. 3 depicts elements of an exemplary system 300 for practicing an aspect of the current invention. A content source 305 may provide program and/or secondary content to a principal-content receiver 310. When the principal content is received at the principal-content receiver 310, either or both of the audio and the video content may be passed to a fingerprint generator 320, whereat one or more reference fingerprints associated with the principal content may be generated according to a fingerprint-generation method known in the art. In alternative embodiments, a content source 305 may provide the one or more reference fingerprints directly to a principal-content receiver 310. The resulting one or more reference fingerprints may be stored in a fingerprint database 330. A unique identifier may associate the one or more reference fingerprints with the principal content from which they were generated. Content source 305 also may provide supplementary content to a supple-

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mentary-content receiver 340. The supplementary content may be stored in a supplementary-content database 350, along with a unique identifier that may associate the supplementary content with the principal content. In some embodiments of the present invention, the unique identifier used within the fingerprint database 330 to associate the one or more reference fingerprints with the principal content from which they were generated may be the same as the unique identifier used within the supplementary-content database 350 to associate the supplementary content with the principal content. In alternative embodiments, the identifiers may be distinct but associated with each other.

A program-stream source 360 may create a broadcast stream 365 comprising audio content and video content of one or more program content and secondary content. A portion of broadcast stream 365 may be monitored by a detector 370. The detector 370 may pass either or both of audio content and video content from the broadcast stream to the fingerprint generator 320. The resulting fingerprints generated from the broadcast stream may be compared with the one or more reference fingerprints from the fingerprint database 330. When a match is found, the detector 370 may produce a first control signal that may be passed to a controller 380, along with the unique identifier associated with the matched reference fingerprint. Upon receiving the first control signal, the controller 380 may use the unique identifier to extract supplementary content associated with the principal content from supplementary-content database 350, and the controller 380 may activate a multiplexer 390 to insert the extracted supplementary content into the broadcast stream 365, thereby producing an enhanced broadcast stream 395. Once a match has been found, the detector 370 continues to monitor the broadcast stream 365, generating fingerprints and comparing the generated fingerprints with the one or more reference fingerprints from the fingerprint database 330. When the detector 370 fails to find a match, the detector 370 may generate a second control signal that may be passed to the controller 380. Upon receiving the second control signal, the controller 380 may deactivate the multiplexer 390 to no longer insert the extracted supplementary content into the enhanced broadcast stream 395.

The system 300 depicted in FIG. 3 is intended to be exemplary, and one skilled in the art will recognize that many details and aspects of system 300 could be modified or altered without departing from the spirit and scope of the current invention. For example, in some embodiments of the present invention, principal content and supplementary content may come from the same source 305. In alternative embodiments, principal content and supplementary content may come from different sources (not shown). In some embodiments of the present invention, principal content and/or supplementary content may be received in tangible form. In alternative embodiments, principal and/or supplementary content may be received in intangible and evanescent form. In some embodiments of the present invention, content may be transported via physical media, for example, tape, disk, memory card, and other physical transportation means. In alternative embodiments of the present invention, content may be provided as evanescent digital or analog signals transmitted via wired or wireless communication means.

In some embodiments of the present invention, the fingerprint generator 320 may be realized as a single system accessible to both the principal-content receiver 310 and the detector 370. In alternative embodiments of the present invention (not shown), the fingerprint generator 320 may be realized as two separate implementations of fingerprint

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generator instances operating at different locations. In some embodiments of the present invention, the process of generating and storing reference fingerprints may occur at a time and/or place distinct from the time and/or place of the operation of the detector **370**. The reference fingerprint database **330** for storing reference fingerprints may be implemented as a flat file stored on a physical medium, as a relational database implemented on a central server computer, as a virtual database implemented using cloud storage techniques, or by other equivalent methods well known in the art. Similarly, the supplementary-content database **350** may be implemented as a flat file, as a relational database, as a virtual database, or by other data storage and retrieval means well known in the art. In some embodiments of the present invention, the principal-content receiver **310** and supplementary-content receiver **340** may be realized as a single module. In alternative embodiments, the principal-content receiver **310** and the supplementary-content receiver **340** may be realized as separate modules. In some embodiments of the present invention, the fingerprint database **330** and the supplementary-content database **350** may be realized as separate databases. In alternative embodiments of the present invention, the fingerprint database **330** and the supplementary-content database **350** may be realized as a single database. The unique identifier associated with principal content and supplementary content may be provided by content source **305**, or may be generated by principal content receiver **310**, by supplementary content receiver **340**, or by a separate unique identifier generator (not shown).

In some embodiments of the present invention, the program-stream source **360** may be a singular entity. In alternative embodiments, the program-stream source **360** may be multiple entities, each providing one or more content streams. The program stream **365** may be communicated via a wired or wireless network, and the program stream **365** may be communicated in digital or analog representation. The detector **370** and the controller **380** may be located in proximity to, or distant from, the program stream source **360**, and/or the multiplexer **390**, and/or each other. Monitoring of the program stream **365** may be performed by any of the well-known monitoring means known in the art, for example, electronic sampling; reception of unicast, multicast, or broadcast internet protocol traffic on a wired or wireless digital network; antenna reception of wireless electromagnetic signals; and other means known in the art. Communication between the detector **370** and the controller **380**, and between the controller **380** and the multiplexer **390**, may be by any conventional wired or wireless means known in the art.

While FIG. **3** depicts only a single instance of each element of system **300**, this is not a limitation of the current invention. In alternative embodiments, other system topographies may be utilized that fall within the spirit and scope of the current invention. For example, a principal-content receiver **310** may communicate with multiple fingerprint generators (one shown) **320**; likewise, multiple principal-content receivers (one shown) **310** may communicate with a single fingerprint generator **320**. A principal-content receiver **310** may store fingerprints in multiple fingerprint databases (one shown) **330**; likewise, multiple principal-content receivers (one shown) **310** may store fingerprints in a single fingerprint database **330**. A supplementary-content receiver **340** may store supplementary content in multiple supplementary-content databases (one shown) **350**; likewise, multiple supplementary-content receivers (one shown) **340** may store supplementary content in a single supplementary-content database **350**. A detector **370** may communicate with

a multiple fingerprint generators (one shown) **320**; likewise multiple detectors (one shown) **370** may communicate with a single fingerprint generator **320**. A detector **370** may communicate with multiple fingerprint databases (one shown) **330**; likewise, multiple detectors (one shown) **370** may communicate with a single fingerprint database **330**. A controller **380** may communicate with multiple supplementary-content databases (one shown) **350**; likewise, multiple controllers (one shown) **380** may communicate with a single supplementary-content database **350**. A detector **370** may monitor multiple program streams (one shown) **365**; likewise, multiple detectors (one shown) **370** may monitor a single program stream **365**. A detector **370** may communicate with a multiple controllers (one shown) **380**; likewise, multiple detectors (one shown) **370** may communicate with a single controller **380**. A controller **380** may communicate with multiple multiplexers (one shown) **390**; likewise multiple controllers (one shown) **380** may communicate with a single multiplexer **390**. The insertion of supplementary content may be performed multiple times on a single program stream, in parallel, in series, or as a combination of series and parallel operations. The foregoing list is not intended to be exhaustive of the possible alternative embodiments of system **300**, but is exemplary of a range of implementations that fall within the spirit and scope of the current invention.

FIG. **3** illustrates the distribution of supplementary content, according to embodiments of the present invention, by incorporating the supplementary content into an enhanced broadcast stream. FIG. **4** depicts exemplary alternative embodiments **400** of the current invention in which supplementary-content broadcast stream **495** may be distributed through a communication channel that is distinct from the communication channel through which the broadcast stream **365** may be distributed. In the alternative embodiments **400**, a content source **305** may provide principal content to a principal-content receiver **310** for processing and storage as described above, and the content source **305** may provide supplementary content to a supplementary-content receiver **340** for storage as described above. A detector **370** may monitor a broadcast stream **365** produced from program streams provided by program stream source **360** as described above. The detector **370** may pass control signals and unique identifiers to a controller **380** as described above. The controller **380** may receive supplementary content from a supplementary-content database **350** as described above. The controller **380** may provide supplementary content **495** retrieved from the supplementary-content database **350** through a wired or wireless communication path independent of the communication path used by broadcast stream **365**. For example, in some alternative embodiments **400** a broadcast stream **365** may be communicated through a terrestrial broadcast system, while supplementary content **495** may be communicated through a wired Internet Protocol (IP) communication system.

In an alternative embodiment, supplementary content **495** may be distributed by a web server that receives supplementary content **495** and first and second control signals from controller **380** through any suitable communication means, for example, a wired IP communication system. In some embodiments, the web server may manage the distribution of supplementary content **495** such that supplementary content **495** may be supplied in response to a query from a client device after the first control signal is generated and received by the web server, but supplementary content **495**

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may no longer be supplied in response to a query from a client device after the second control signal is generated and received by the web server.

FIG. **5** depicts a flowchart **500** of an exemplary process, according to embodiments of the present invention, to be executed in a detector **370** of exemplary systems **300** and **400**. At a step **510**, the detection module may be initialized. At a further step **520**, samples may be extracted from a broadcast stream **365**, and a fingerprint may be generated from the samples, for example, by means of a fingerprint generator **320**. The samples may be taken, for example, from a video stream, from an audio stream, or from both video and audio streams. The fingerprints, for example, may be computed from and may represent a single field of video, a single frame of video, a series of sequential audio samples, or other data taken from the broadcast stream. At a further step **530**, the generated fingerprint may be compared with a plurality of reference fingerprints, for example, those extracted from a fingerprint database **330**. At a further step **540**, a determination may be made whether the generated fingerprint matches a reference fingerprint. If no match is found **542**, execution may return to a step **520**. If a match is found **544**, at a further step **550**, a unique identifier associated with the matched reference fingerprint may be stored, and a first control signal may be generated. The control signal may include the unique identifier. At a further step **560**, samples may be extracted from a broadcast stream **365**, and a fingerprint may be generated from the samples. At a further step **570**, the generated fingerprint may be compared with reference fingerprints. At a further step **580**, a determination may be made whether the generated fingerprint matches a reference fingerprint. If a match is found **582**, execution may return to step **560**. If no match is found **584**, at a further step **590** a second control signal may be generated, and execution may return to a step **510**.

Upon further development, the inventors of the current invention recognized that the exemplary process depicted in FIG. **5** may be inadequate in certain respects. FIG. **6** demonstrates a situation in which a more complex detection process may be required. In some series, every episode of the series, or all episodes in the current season of the series, may have the same introductory scene content. FIG. **6** illustrates, in schematic form, the content of three episodes **602**, **604**, **606** of a television series that share common content. Episode A **602** comprises introductory scene Intro, followed by scenes S2*a*, S3*a*, S4*a*, S5*a*, S6*a*, S7*a*, S8*a*, and S9*a*. Episode B **604** comprises introductory scene Intro, followed by scenes S2*b*, S3*b*, S4*b*, S5*b*, S6*b*, S7*b*, and S8*b*. Episode C **606** comprises introductory scene Intro, followed by scenes S2*c*, S3*c*, S4*c*, S5*c*, S6*c*, S7*c*, S8*c*, S9*c*, and S10*c*. In this circumstance, if a fingerprint database contains the reference fingerprints of Episode A **602**, Episode B **604**, and Episode C **606**, fingerprints generated during the monitoring of any of the three episodes will match the reference fingerprints of all of the three episodes for the duration of the introductory scene, Intro, which would prevent an unambiguous identification of the actual episode being played. Inasmuch as the process depicted in FIG. **5** does not recognize the potential for ambiguous fingerprint matches, a more complex process may be required to handle this situation and other similar situations in which multiple episodes comprise common content.

A further deficiency of the exemplary process depicted in FIG. **5** may be that the process does not take account of the relative offsets of reference fingerprints that match with fingerprints generated from samples taken from the broadcast stream. Fingerprint matching algorithms known in the art are typically designed to process content that may have been degraded or distorted from the original, for example, audio content captured in an ambient environment that introduces noise, or audio content that has been temporally compressed or expanded. This robustness in matching may result in spurious matches between sampled content and reference content that is similar, but not identical. The finite duration of fingerprint sampling windows also allows for spurious matches in circumstances where fragments of the content are repeated, such as a short musical theme that repeats multiple times during a program. Robust identification of a program would preferentially utilize offset data from matched reference fingerprints to improve the rate of true positive matches and reduce the rate of false positive matches.

Accordingly, FIGS. **7***a*, **7***b*, and **7***c* depict a flowchart **700** of a preferred exemplary fingerprint matching process, according to embodiments of the present invention, to be executed in a detector **370** of exemplary systems **300** and **400**. In FIG. **7***a*, an exemplary process **700** may commence at a step **702** at which a detection module may be initialized, erasing all memory of previous activity. At a further step **704**, match identifier, offset, and counter storage locations may be cleared of their contents. At a further step **706**, a selected broadcast stream may be sampled and a fingerprint may be generated, for example, by means of a fingerprint generator **320**. The samples may be taken, for example, from a video stream, from an audio stream, or from both a video and an audio stream. The fingerprint, for example, may be computed from and may represent a single field of video, a single frame of video, a series of sequential audio samples, or other data taken from the broadcast stream. At a further step **708**, the generated fingerprint may be compared with a plurality of reference fingerprints, for example, those extracted from a fingerprint database **330**. At a further step **710**, a determination may be made whether the generated fingerprint unambiguously matches a single reference fingerprint. If not **712**, control returns to a step **704**. If an unambiguous match is found **714**, at a further step **716** a determination may be made whether a previous unambiguous match was made, for example, by checking for a value stored in a match-identifier storage location. If no previous match was made **718**, at a further step **720** a determination may be made whether the offset corresponding to the unambiguous match is valid. When performing continuous sampling, a valid offset may be an offset within the initial portion of the program content, whereas an invalid offset may be an offset late in the program content. The test of step **720** allows the system to avoid a spurious match to content contained within later portions of the program content. This situation might arise, for example, in a program episode in which a later portion of the program episode contains preview content for the next successive program episode in the series. If at step **720** a determination is made that the offset is not valid **722**, control returns to step **706**. If at step **720** a determination is made that the offset is valid **724**, at a further step **726**, the identifier of the matching fingerprint may be remembered by storing the identifier in the match-identifier storage location. At a further step **728**, the match offset storage location may be set with the offset of the matching reference fingerprint, and the match counter storage location may be incremented.

If at a step **716**, a previous match was found **730**, at a further step **732** a determination may be made whether the offset of the new matching reference fingerprint is valid with respect to the match offset stored in the match offset storage location. In the determination of step **732**, the offset of the

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new match will be valid with respect to the previous match offset, for example, if the new offset is greater than the previous match, but the time difference between the new offset and the previous offset does not exceed a maximum value. The allowable difference between offsets may be determined by the type and nature of the fingerprints. For example, if fingerprints are generated from video content and each fingerprint represents a single frame of video, then, in some embodiments of the present invention, the allowable difference between two successive fingerprints should be no more than one frame of video. As another example, if fingerprints are generated from audio content and each fingerprint represents the values in a window of audio samples, then, in some embodiments of the present invention, the allowable difference between two matches should be no more than five times the step between two successive reference fingerprint windows. Defining a maximum allowable difference may compensate for the imprecise nature of fingerprint matches, particularly for audio samples, and may help make the process robust against sampling differences between reference and live samples.

If at step **732** a determination is made that the offset of the newly matched reference fingerprint is not valid **734** with respect to the previous match, control passes to step **704** and the search process restarts. If at step **732** a determination is made that the offset of the newly matched reference fingerprint is valid **736** with respect to the previous match, control passes to step **728**. Following step **728**, at a further step **738**, a determination may be made whether the contents of the match counter storage location are equal to a predefined limit. A preferred value, in some embodiments of the present invention, for the predefined limit for accepting a program match is three consecutive matches. If at step **738** a determination is made that the match count is less than the limit **740**, control may pass to step **706**. If at step **738** a determination is made that the match count is equal to the limit **742**, then control passes to a step **744** depicted in FIG. 7*b*.

With reference to FIG. 7*b*, at a step **744** a first control signal may be generated. At a further step **746**, an error-counter storage location may be cleared. At a further step **748**, the selected stream may be sampled and a fingerprint may be generated. At a further step **750**, the generated fingerprint may be compared with a plurality of reference fingerprints. At a further step **752**, a determination may be made if a match is found with a reference fingerprint whose identifier matches the identifier stored in the match identifier storage location. If a match is found **754**, at a further step **756**, a determination may be made whether the offset of the matching reference fingerprint is valid relative to the previous offset stored in the match offset storage location. In the determination of step **756**, the offset of the new match will be valid with respect to the previous match offset, for example, in some embodiments of the present invention, if the new offset is greater than the previous match but the time difference between the new offset and the previous offset does not exceed a maximum value. In some embodiments of the present invention, the allowable difference between offsets may be determined by the type and nature of the fingerprints. Prior to step **756** the match with a given reference program has been made with high confidence, so the allowable difference at step **756** is greater than the allowable difference at step **732**. Defining a maximum allowable difference at step **756** that is greater than the maximum allowable difference at step **732** may compensate for the imprecise nature of fingerprint matches, particularly for audio samples, and avoid situations where matches may not be found, for example in dark transitions in video or in low volume or silent intervals in the audio content. In some embodiments, for example, if fingerprints are generated from video content and each fingerprint represents a single frame of video, then the allowable difference between two successive fingerprints may be as great as three frames of video. In alternative embodiments, as another example, if fingerprints are generated from audio content and each fingerprint represents the values of a window of audio samples, then the allowable difference between two matches may be as long as the duration of the audio sampling window.

If at step **752** a determination is made that no match **758** is found with a reference fingerprint whose identifier matches the identifier stored in the match identifier storage location, control passes to a further step **760** depicted in FIG. 7*c*. If at step **756** a determination is made that the offset of the new match is valid **762** with respect to the previous match offset, at a further step **764**, the offset of the new match is stored, and control passes to step **748**. If at step **756** a determination is made that the offset of the new match is not valid **766** with respect to the previous match offset, control passes to a further step **768** depicted in FIG. 7*c*.

With reference to FIG. 7*c*, at a step **760** a determination may be made if a match is found between the newly-generated fingerprint and a reference fingerprint from any other program content. If no match is found **770**, at a further step **772** a determination may be made if the match has been lost. In some embodiments of the present invention, a match may be lost if a sufficient period of sampling passes with no match being made to any generated fingerprint. For example, in some embodiments, if fingerprints are generated from video content and each fingerprint represents a single frame of video, then if four frames of video are fingerprinted without finding a matching reference fingerprint, then a determination may be made that a match is lost. As another example, if fingerprints are generated from audio content and each fingerprint represents the values of a window of audio samples, then, in some embodiments, if a period equal to the audio sample window passes without finding a matching reference fingerprint, a determination is made that a match is lost. If at step **772** a determination is made that the match has not been lost **774**, control passes to step **748**. If at step **772** a determination is made that the match has been lost **776**, control passes to a further step **778**.

If at step **760** a match to a reference fingerprint is found **780** with an identifier that does not match the stored match identifier, at a further step **768**, an error counter storage location may be incremented. At a further step **782**, a determination may be made whether the error count exceeds a predefined limit. In some embodiments of the present invention, a preferred value for the predefined limit for the error count may be three consecutive errors without a valid match. If the error count is less than the predefined limit **784**, control passes to step **748**. If the error count exceeds the predefined limit **786**, at a further step **778** a second control signal may be generated, and control passes to step **702** where the process may restart.

By way of further explanation of embodiments of the current invention, consider the use of system **300** utilizing the detection method depicted in flowchart **700** operating on the content depicted in FIG. **2**. The original content **200** depicted in FIG. **2** is received by principal content receiver **310** and passed through fingerprint generator **320**. The resulting plurality of reference fingerprints is stored in fingerprint database **330**. Supplementary content is received and stored in supplementary-content database **350**. Suppose the broadcast content **365** being sampled by detector **370**

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contains the first broadcast **202** content depicted in FIG. **2**. At the beginning of scene S1, detector **370** will sample the content of scene S1 and generate fingerprints at step **706**. After some latency that depends on the fingerprint generation algorithm, at steps **708** and **710** generated fingerprints will begin to match the reference fingerprints stored in fingerprint database **330**. After a sufficient number of matches at step **738**, at step **744** a first control signal will be generated. As the broadcast continues, broadcast content will be sampled and reference fingerprints will be generated at step **748**, and at step **750**, **752**, and **756**, the generated fingerprints will continue to match reference fingerprints with valid offsets throughout the broadcast of scenes S1 and S2. Subsequent to the beginning of interstitial pod C1a, at step **752** generated fingerprints will not match reference fingerprints, since the content of C1a does not appear in the original program content and fingerprint database **330** will not contain fingerprints that match those generated during C1a. Once a sufficient period elapses with no matching fingerprints, at step **772** a loss of match will be determined and at step **778** a second control signal will be generated. At the end of interstitial pod C1a, and after a latency that depends on the fingerprint generation algorithm, at steps **708** and **710** generated fingerprints from scene S3 will again begin to match the reference fingerprints stored in fingerprint database **330**. After a sufficient number of matches at step **738**, at step **744** a first control signal will again be generated. Matching will continue at steps **752** and **756** until interstitial pod C2a, at which point the match will be lost at step **772** and a second control signal will be generated at step **778**. This pattern will continue throughout the illustrated period of the first broadcast **202**.

If at a later time the broadcast content contains the second broadcast **204** content depicted in FIG. **2**, a similar pattern of first and second control signals will be generated, although the precise timing of the signals will vary according to the placement and duration of the interstitial pods. Similarly, if at a later time the broadcast content contains the third broadcast **206** content depicted in FIG. **2**, a similar pattern of first and second control signals will be generated, although in this case the first occurrence of the second control signal will occur during the middle of scene S3, and the second occurrence of the first control signal will occur following the end of interstitial pod C1c but during the middle of scene S3.

FIG. **8** depicts an exemplary scenario for the broadcast and recognition of the content depicted in FIG. **6**. Again, by way of further explanation of embodiments of the current invention, consider the use of system **300** utilizing the detection method depicted in flowchart **700** operating on the broadcast content as depicted in FIG. **8**. The original content of Episode A **602** is received by principal content receiver **310** and passed through fingerprint generator **320**. The resulting reference fingerprints are stored in fingerprint database **330**. Supplementary content is received and stored in supplementary-content database **350**. Suppose the broadcast content **365** being sampled by detector **370** contains the as-broadcast content **802** depicted in FIG. **8**, where interstitial pods C1, C2, C3, and C4 are interspersed in the content of Episode A. At the beginning of scene Intro, detector **370** will sample the content of scene Intro and generate fingerprints at step **706** that when compared with the reference fingerprints stored in fingerprint database **330** at step **708** will unambiguously match the reference fingerprints for the Intro scene of Episode A at step **710**. After a sufficient number of consecutive matches at step **738**, a first control signal will be generated at step **744**. Fingerprints generated

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from sampled content at step **748** will continue to match at step **752** until the start of interstitial pod C1. After no match is found at step **772**, a second control signal will be generated at step **778**, and the process will restart. Subsequently a first control signal will be generated after the start of scene S3a, and a second control signal will be generated after the start of interstitial pod C2. Likewise, first control signals will be generated after the starts of scenes S5a, S7a, and S8a, and second control signals will be generated after the ends of scenes S4a, S6a, S7a, and S9a.

As described above, the contents of each of the three episodes depicted in FIG. **6** contains the same introductory scene. A robust detection system must be capable of disambiguating these episodes despite the presence of the common material. By way of illustration of this requirement, FIG. **9** depicts another exemplary scenario for the broadcast and recognition of the content depicted in FIG. **6**. Again, by way of further explanation of the current invention, consider the use of system **300** utilizing the detection method depicted in flowchart **700** operating on the broadcast content as depicted in FIG. **9**. The original content of Episodes **1** **602** and **2** **604** is received by principal-content receiver **310** and passed through fingerprint generator **320**. The resulting plurality of reference fingerprints is stored in fingerprint database **330**. Supplementary content is received by supplementary-content receiver **340** and stored in supplementary-content database **350**. Suppose the broadcast content **365** being sampled by detector **370** contains the as-broadcast content **902** depicted in FIG. **9**, where interstitial pods C1, C2, C3, and C4 are interspersed in the content of Episode A **602**. At the beginning of scene Intro, detector **370** will sample the content of scene Intro and generate fingerprints at step **706** that will match the reference fingerprints stored in the reference fingerprint database **330** at step **708** for both scene Intro of Episode A and scene Intro for Episode B **604**. Accordingly, at step **710** a determination is made that an unambiguous match is not found **712**, so control will pass to step **704** without a match identifier being set. Only when scene S2a begins to play will detector **370** generate fingerprints at step **706** that when compared with the reference fingerprints at step **708** will produce an unambiguous match **714** with the reference fingerprints from the content of Episode A **602**. After a sufficient number of consecutive matches from the content of scene S2a at step **738**, a first control signal will be generated at step **744**. Therefore, in this scenario **902** the first control signal will be delayed relative to the scenario **802** shown in FIG. **8**, because unambiguous identification of the content is not possible during the introductory scene, which is common to both Episode A **602** and Episode B **604**. After the initial match, fingerprints generated from sampled content at step **748** will continue to match at step **750** until the start of interstitial pod C1, at which point no match will be found at step **772** and at step **778** a second control signal will be generated, and the process will restart. Thereafter the generation of first and second control signals will proceed as described above with respect to the scenario **802** depicted in FIG. **8**.

Further considering the broadcast of the content depicted in FIG. **6**, FIG. **10** depicts a broadcast scenario that is problematic for proper detection and identification. In this scenario reference content comprises Episode B **604**, while broadcast content comprises Episode A **602**. Consider the use of system **300** utilizing the detection method depicted in flowchart **700** operating on the broadcast content as depicted in FIG. **10**. The original content of Episode B **604** is received by principal content receiver **310** and passed through fingerprint generator **320**. The resulting plurality of reference

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fingerprints is stored in fingerprint database **330**. Supplementary content is received and stored in supplementary-content database **350**. Suppose the broadcast content **365** being sampled by detector **370** contains the as-broadcast content **1002** depicted in FIG. **10**, where interstitial pods C**1**, C**2**, C**3**, and C**4** are interspersed in the content of Episode A **602**. At the beginning of scene Intro, detector **370** will sample the content of scene Intro and generate fingerprints at step **706** that will match the reference fingerprints stored in the reference fingerprint database **330** at step **708** for scene Intro for Episode B **604**, even though the content of Episode A **602** is being broadcast. Accordingly, at step **710** an erroneous but unambiguous match will be found, and after a sufficient number of sequential matches within scene Intro at step **738**, a first control signal will be generated at step **744**. This first control signal will identify the content as being Episode B **604**, based on the matches generated by the common introductory material, but this identification is in error. Subsequently, fingerprints generated at step **748** and compared with reference fingerprints from fingerprint database **330** at step **750** will continue to match at steps **752** and **756**. Only when scene S**2**a is being sampled will fingerprints fail to match at step **772**, and at step **778** a second control signal will be generated. Subsequently fingerprints sampled from the remainder of the as-broadcast content **1002** will fail to match with the reference fingerprints of Episode B **604**, so no further first or second control signals will be generated for the duration of the as-broadcast content **1002**.

The inventors of the current invention recognized this problem scenario and developed alternative embodiments of the present invention comprising a method to avoid this improper content recognition. This method may be useful in any situation where a number of episodes of a program share common introductory material, but not all of the episodes that may be broadcast have been provided as reference content to be stored in the fingerprint database. This method is depicted in schematic form in FIG. **11**. In this method, a new dummy reference episode **1100** may be created comprising the initial common content from any of the episodes of the series. The dummy reference episode **1100**, which is labeled as Dummy Episode in the exemplary scenario depicted in FIG. **11**, may be supplied to principal content receiver **310** along with the normal episode content. The dummy reference content may be passed through the fingerprint generator **320** and the resulting plurality of reference fingerprints may be stored in fingerprint database **330**. The presence of the reference fingerprints for the dummy reference in the fingerprint database will cause ambiguous matches to occur during the initial common content. Because in this scenario an unambiguous match will never be made to the dummy reference content, supplementary content associated with the dummy reference content is not required.

Consider the use of system **300** utilizing the detection method depicted in flowchart **700** operating on the broadcast content as depicted in FIG. **11**. The original content of Episode B **604** and Dummy Episode **1100** is received by principal content receiver **310** and passed through fingerprint generator **320**. The resulting plurality of reference fingerprints is stored in fingerprint database **330**. Supplementary content for Episode B **604** is received and stored in supplementary-content database **350**. Suppose the broadcast content **365** being sampled by detector **370** contains the as-broadcast content **1102** depicted in FIG. **11**, where interstitial pods C**1**, C**2**, C**3**, and C**4** are interspersed in the content of Episode A **602**. At the beginning of scene Intro, detector **370** will sample the content of scene Intro and

generate fingerprints at step **706** that will match the reference fingerprints stored in the reference fingerprint database **330** at step **708** for both scene Intro of Episode B **604** and scene Intro for Dummy Episode **1100**. Accordingly, at step **710** a determination is made that an unambiguous match is not found, so control will pass to step **704** without a match identifier being set. This situation will persist through scene Intro, and no unambiguous match will be found. When scene S**2**a begins to play, detector **370** will generate fingerprints at step **706** that when compared with the reference fingerprints at step **708** will produce no matches, so during the further playout of the as-broadcast content **1102** depicted in FIG. **11**, no control signals will be generated. Thus, the presence of the reference fingerprints for Dummy Episode **1100** in the fingerprint database **330** prevents the improper identification of the content of the Intro scene, and the system **300** performs as desired.

While preferred embodiments of the invention have been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of a preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

What is claimed is:

1. In a computer system, a method for controlling a distribution of supplementary content, the method comprising:

receiving a media content comprising at least one of an audio content and a video content;

receiving a supplementary content associated with the media content;

in a broadcast system:

monitoring a broadcast stream;

when the monitoring initially detects either one of the at least one of an audio content and a video content:

determining that a count of unambiguous matches for the initially detected either one of the at least one of an audio content and a video content, when compared to a reference database, meets a first criterion in relation to a first predefined limit; and

based on the count of unambiguous matches for the initially detected either one of the at least one of an audio content and a video content, when compared to the reference database, meeting the first criterion in relation to the first predefined limit:

selecting the supplementary content based on the detected media content;

generating a first control signal; and

using the first control signal to control the distribution of the selected supplementary content;

and

when the monitoring fails to detect the initially detected either one of the at least one of an audio content and a video content subsequent to the initial detection:

generating a second control signal; and

using the second control signal to control the distribution of the selected supplementary content.

2. The method of claim **1**, further comprising:

upon receiving the media content and the supplementary content associated with the media content, assigning a unique identifier to an enhanced media content comprising the media content and the supplementary content.

3. The method of claim **2**, further comprising creating a first database, wherein the creating the first database comprises:

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generating a plurality of reference fingerprints from the at least one of an audio content and a video content;

associating the plurality of reference fingerprints with the unique identifier of the enhanced media content; and

storing the plurality of reference fingerprints, the unique identifier, and the association in the first database.

4. The method of claim **3**, further comprising:

generating a first fingerprint from at least one of a received audio content and a received video content from the monitored broadcast stream;

comparing the first fingerprint with the plurality of reference fingerprints;

wherein the monitoring initially detects either one of the at least one of an audio content and a video content when a match between any reference fingerprint in the plurality of reference fingerprints and the first fingerprint is initially determined.

5. The method of claim **4**, further comprising extracting the unique identifier associated with the plurality of reference fingerprints from the first database when the monitoring initially detects either one of the at least one of an audio content and a video content.

6. The method of claim **3**, further comprising:

generating a first fingerprint from at least one of a received audio content and a received video content from the monitored broadcast stream;

comparing the first fingerprint with the plurality of reference fingerprints;

wherein the monitoring fails to detect the initially detected either one of the at least one of an audio content and a video content when none of the reference fingerprints in the plurality of reference fingerprints matches the first fingerprint.

7. The method of claim **2**, further comprising creating a second database, wherein creating the second database comprises:

creating an association between the unique identifier for the enhanced media content and the supplementary content associated with the media content;

storing the unique identifier, the supplementary content, and the association in the second database; and

using the unique identifier to extract supplementary content from the second database.

8. The method of claim **1**, further comprising:

upon generating the first control signal, inserting the supplementary content into the broadcast stream.

9. The method of claim **8**, further comprising:

upon generating the second control signal, ceasing to insert the supplementary content into the broadcast stream.

10. The method of claim **1**, further comprising, when the monitoring fails to detect the initially detected either one of the at least one of an audio content and a video content subsequent to the initial detection, determining that an error count of match failures for the initially detected either one of the at least one of an audio content and a video content, when compared to the reference database, meets a second criterion in relation to a second predefined limit.

11. A system for the control of a distribution of supplementary content, the system comprising:

a receiver for receiving:

a media content comprising at least one of an audio content and a video content; and

a supplementary content associated with the media content;

a monitor for monitoring, in a broadcast system, a broadcast stream;

a detector, in the broadcast system, for:

detecting, in the broadcast stream, either one of the at least one of the audio content and the video content of the received media content; and

upon initially detecting either one of the at least one of the audio content and the video content:

determining that a count of unambiguous matches for the at least one of an audio content and a video content, when compared to a reference database, meets a first criterion in relation to a first predefined limit; and

generating a first control signal; and

after failing to detect, subsequent to the initial detection, the initially detected either one of the at least one of the audio content and the video content, generating a second control signal; and

a controller for:

selecting, based on the count of unambiguous matches for the at least one of an audio and a video content, when compared to the reference database, meeting the first criterion in relation to the first defined limit, a first supplementary content based on the initially detected either one of the at least one of the audio content and the video content; and

using the first control signal and the second control signal to control the distribution of the first supplementary content.

12. The system of claim **11**, further comprising:

an identifier for assigning a unique identifier to an enhanced media content comprising the media content and the supplementary content.

13. The system of claim **12**, further comprising:

a fingerprint calculator for computing a plurality of reference fingerprints from the received media content; and

a first database for:

receiving the plurality of reference fingerprints and the unique identifier;

associating the plurality of reference fingerprints and the unique identifier, and

storing and retrieving the plurality of reference fingerprints, the unique identifier, and the association between the plurality of reference fingerprints and the unique identifier;

wherein the monitor is additionally for:

generating a first fingerprint from the at least one of a received audio content and a received video content in the monitored broadcast stream;

comparing the first fingerprint with the plurality of reference fingerprints retrieved from the first database; and

determining whether the first fingerprint matches any fingerprint in the plurality of reference fingerprints.

14. The system of claim **12**, further comprising:

a second database for:

receiving the supplementary content and the unique identifier;

associating the supplementary content and the unique identifier, and

storing and retrieving the supplementary content, the unique identifier, and the association between the supplementary content and the unique identifier.

15. In a computer system, a method for controlling a distribution of supplementary content, the method comprising:

receiving a media content comprising at least one of an audio content and a video content;

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receiving a supplementary content associated with the media content;

in a broadcast system:

monitoring a broadcast stream;

when the monitoring initially detects either one of the at least one of an audio content and a video content:

selecting the supplementary content based on the detected media content;

generating a first control signal;

sending the first control signal to the web server; and

using the first control signal, at the web server, to control the distribution of the selected supplementary content;

and

when the monitoring fails to detect the initially detected either one of the at least one of an audio content and a video content subsequent to the initial detection:

determining that multiple error counts of match failures for the initially detected either one of the at least one of an audio content and a video content, when compared to the reference database, meets a criterion in relation to a predefined limit, and based on meeting the criterion:

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generating a second control signal; and

using the second control signal to cease to insert the selected supplementary content into the broadcast stream.

16. The method of claim 15, further comprising:

upon receiving the media content and the supplementary content associated with the media content, assigning a unique identifier to an enhanced media content comprising the media content and the supplementary content.

17. The method of claim 16, further comprising creating a first database, wherein the creating the first database comprises:

generating a plurality of reference fingerprints from the at least one of an audio content and a video content;

associating the plurality of reference fingerprints with the unique identifier of the enhanced media content; and

storing the plurality of reference fingerprints, the unique identifier, and the association in the first database.

* * * * *

Exhibit B

US009420349B2

(12) **United States Patent**

Harper et al.

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(54) **METHODS AND SYSTEMS FOR MONITORING A MEDIA STREAM AND SELECTING AN ACTION**

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H04N 21/434	(2011.01)
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(57)   **ABSTRACT**

Aspects of the present invention are related to systems, methods and apparatus for selecting an action when known content is detected in a media stream.

17 Claims, 4 Drawing Sheets

FIG. 1

FIG. 2

Object A   300

Intro	Scene A1	Scene A2

330   331   332

Object B   310

Intro	Scene B1	Scene B2

333   334

Object C   320

Scene C1	Scene C2

340   341

FIG. 3

400

Initialize detection module — 410

Sample stream, generate fingerprint — 420

Compare fingerprint with reference fingerprints — 430

442
No   Match found?   Yes — 444
440

No   Single match? — 450
452

Yes — 454

472
No   Common action for all matches? — 470

Select action associated with match — 460

Yes — 474

Select action associated with all matches — 480

Perform selected action — 490

FIG. 4

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METHODS AND SYSTEMS FOR MONITORING A MEDIA STREAM AND SELECTING AN ACTION

FIELD OF THE INVENTION

Embodiments of the present invention relate generally to methods and systems for monitoring a media stream and selecting an action and, in particular, to methods and systems for monitoring a media stream and selecting an action using a media-content fingerprint.

BACKGROUND

An ability to provide viewer-selectable interactivity and other actions in conjunction with still-image, audio and/or video content may be a desirable capability in a broadcast system. A required capability in a system intended for this purpose may be an ability to control activity during discontinuities in program content, for example, commercial breaks, emergency broadcast interruptions, and other program-content discontinuities. Existing systems for providing viewer-selectable interactivity in conjunction with still-image audio and/or video content may be problematic in many broadcast environments because of existing systems' reliance on specific signaling content in the broadcast stream. No standardized method for conveying such signals is provided across the multiple broadcast methodologies, for example, cable, terrestrial, satellite, Internet Protocol, and other broadcast methodologies, that may be used to distribute program content. Furthermore, signals that are introduced into a broadcast stream at one point in a distribution chain may be modified or removed at a later point in the processing of the broadcast stream prior to reception by the viewer. Additionally, the insertion of commercial content into program content may vary with respect to the timing, duration and identity of the commercial content during each unique broadcast of a particular piece of program content and for each method of broadcast of the program content. Due to this variability, existing systems may require control signals be inserted specifically for each presentation of the program content.

Existing still-image/audio/video content recognition systems may receive still-image/audio/video input and perform a specified action appropriate to the identity of the still-image/audio/video content. Existing systems may fail to perform actions when still-image/audio/video content identification cannot disambiguate between two or more sources, for example when two or more still-image/audio/video reference sources share substantially identical content.

Methods and systems that monitor still-image/audio/video content and select a specified action to perform when still-image/audio/video content identification identifies two or more possible still-image/audio/video sources as substantially identical may be desirable.

SUMMARY

Some embodiments of the present invention relate to methods, systems and apparatus for monitoring a media stream and performing an action by receiving a plurality of media objects, each media object comprising an initial content portion that is substantially identical to the initial content portion of each of the other media objects in the plurality of media objects and a subsequent content portion unique to the each media object; associating an action with the plurality of media objects; receiving a media stream comprising one of the plurality of media objects; detecting that the media stream

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contains the substantially identical portion shared by each of the media objects in the plurality of media objects; and selecting the action associated with the plurality of media objects.

One aspect of the present invention teaches creating a set of reference fingerprints for each of the media objects in a plurality of media objects; associating a unique fingerprint-media-object identifier with each of the media objects in the plurality of media objects; adding each of the reference-fingerprint sets in the plurality of reference-fingerprint sets to a fingerprint database; providing the fingerprint database to a fingerprint identifier; creating a fingerprint from a portion of the content of a received media stream; transmitting the fingerprint to the fingerprint identifier; and receiving from the fingerprint identifier a response comprising a plurality of fingerprint-media-objects identifiers identifying each of the plurality of media objects.

Another aspect of the present invention further teaches receiving a first media object; the first media object not sharing any substantially identical content with the media objects in the plurality of media objects; associating a first action with the first media object; receiving a media stream comprising in part the first media object; detecting that the media stream comprises the first media object; and performing the first action associated with the first media object.

Yet another aspect of the present invention further teaches creating a first set of reference fingerprints for the first media object; associating a unique first fingerprint-media-object identifier with the first media object; adding the first set of reference fingerprints to a fingerprint database; providing the fingerprint database to a fingerprint identifier, creating a fingerprint from a portion of the content of the received media stream; transmitting the fingerprint to the fingerprint identifier; and receiving from the fingerprint identifier a response comprising a media identifier identifying the first media object.

Yet another aspect of the present invention teaches receiving a media stream; generating a fingerprint from a portion of the content of the media stream; transmitting the fingerprint to a media identifier system; receiving from the media identifier system a response comprising a plurality of media identities matching the fingerprint; and selecting an action appropriate to all of the media identities.

The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL DRAWINGS

FIG. **1** depicts an exemplary system for practicing an aspect of embodiments of the present invention;

FIG. **2** depicts an alternative embodiment of an exemplary system for practicing an aspect of embodiments of the present invention;

FIG. **3** depicts three media objects that comprise a shared, substantially identical content element and unique content elements; and

FIG. **4** depicts a flowchart of an exemplary process for monitoring a media stream and performing actions according to an embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Embodiments of the present invention will be best understood by reference to the drawings, wherein like parts are

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designated by like numerals throughout. The figures listed above are expressly incorporated as part of this detailed description.

As used herein, the term "media object" refers to a body of still-image content, audio content and/or video content. The still-image, audio and/or video content may be conveyed in analog form, for example as a frequency-modulated radio-frequency electromagnetic wave. Alternatively, the still-image, audio and/or video content may be conveyed in digital form, for example as a stream of numerical values constituting a Moving Picture Experts Group (MPEG) transport stream or, as a further example, as a stream of numerical values constituting a still image. The representation of the content of a media object may be ephemeral or durable. When the representation is durable, for example, as a compact disc encoding audio content, the content is to be recognized as distinct from the physical medium embodying the content.

As used herein, the term "media stream" refers to one or more sequences of one or more media objects, conveyed in analog or digital form.

As used herein, the terms "program" and "program content" refer to set of one or more media objects intended to be consumed by a viewer as a unified entity for entertainment, diversion, information, education, or other viewer-related purposes. Program content may be produced by a "programmer," for example, an individual, a group, a commercial company, a non-profit organization, and other program-content-production entity. A "series" is a set of programs that share common thematic, stylistic, and/or structure elements, and that are intended to be consumed as an artistic whole. Each of the set of programs in a series is an "episode" of the series.

As used herein, the phrase "secondary content" refers to non-program media objects, for example, advertisements, news items, public service announcements, station identification spots, and other non-program content. In a broadcast system, program content may be presented in a discontinuous fashion with various objects of secondary content interleaved within the program content.

As used herein, the phrase "supplementary content" refers to at least one of audio, video, still images, text, executable code, and other data intended for utilization with primary content, for example, program content and secondary content. Supplementary content may be associated with program content or with secondary content. Supplementary content may encode or define an action to be performed. Alternatively, supplementary content may be distributed with primary content, wherein the distribution constitutes an action.

As used herein, the phrase "media content" refers to the content of a media object, which may comprise either program content or secondary content.

As used herein, the phrase "program stream" refers to a sequence of analog or digital data comprising program and secondary content, and possibly including supplementary content.

As used herein, the phrase "broadcast stream" refers to an aggregation of one or more program streams.

As used herein, the terms "broadcast" and "broadcasting" refer to the process of aggregating program content, secondary content, and possibly supplementary content into at least one program stream, aggregating one or more program streams into a broadcast stream, and delivering the broadcast stream to one or more entities. Elements of program, secondary, and supplementary content may be inserted, removed, modified, or replaced during the generation and manipulation of a program stream. A "broadcaster" is an entity that operates a broadcast system.

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As used herein, the terms "distribute" and "distribution" refer to the process of delivering a broadcast stream to viewers through a physical delivery network. The physical delivery network may utilize wired, wireless, or a combination of wired and wireless means. A "distributor" is an entity that operates a distribution system. A broadcast stream may be modified during distribution by inserting, removing, modifying, or replacing elements of one or more program streams within the broadcast stream.

As used herein, the terms "interactive" and "interactivity" refer to the capability, in a viewing environment, for a viewer to control the presentation of program, secondary, and/or supplementary content through direct or indirect manipulation of an interface through a remote control, mouse, keyboard, touch panel, movement recognition camera, microphone and other interface mechanisms.

As used herein, the term "fingerprint" refers to a value or set of values computed as a condensed mathematical representation of the information contained within some subset of the still-image, audio and/or video content of a media object.

As used herein, the phrase "substantially identical," when applied to all or a portion of each of two media objects, means that, to a human observer, the relevant portions of the media objects appear identical, are perceived as identical or otherwise cannot be differentiated, and that, to a media identifier system, the relevant portions of the media objects cannot be distinguished and would be identified as being all, or a portion of, the same media object.

It will be readily understood that the components of the present invention, as generally described and illustrated in the figures herein, could be arranged and designed in a wide variety of different configurations. Thus, the following more detailed description of the embodiments of the methods, systems and apparatus of the present invention is not intended to limit the scope of the invention, but it is merely representative of the presently preferred embodiments of the invention.

Elements of embodiments of the present invention may be embodied in hardware, firmware and/or a non-transitory computer program product comprising a computer-readable storage medium having instructions stored thereon/in which may be used to program a computing system. While exemplary embodiments revealed herein may only describe one of these forms, it is to be understood that one skilled in the art would be able to effectuate these elements in any of these forms while resting within the scope of the present invention.

Although the charts and diagrams in the figures may show a specific order of execution, it is understood that the order of execution may differ from that which is depicted. For example, the order of execution of the blocks may be changed relative to the shown order. Also, as a further example, two or more blocks shown in succession in a figure may be executed concurrently, or with partial concurrence. It is understood by those with ordinary skill in the art that a non-transitory computer program product comprising a computer-readable storage medium having instructions stored thereon/in which may be used to program a computing system, hardware and/or firmware may be created by one of ordinary skill in the art to carry out the various logical functions described herein.

The steps of the flowcharts described herein may be performed by software executing on hardware, by specialized hardware systems, or by a combination of software and specialized hardware. Certain steps of the flowcharts may be amenable to manual performance, but in general the flowcharts represent processes or operations that require hardware systems for their realization.

Some embodiments of the present invention may comprise a computer program product comprising a computer-readable

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storage medium having instructions stored thereon/in which may be used to program a computing system to perform any of the features and methods described herein. Exemplary computer-readable storage media may include, but are not limited to, flash memory devices, disk storage media, for example, floppy disks, optical disks, magneto-optical disks, Digital Versatile Discs (DVDs), Compact Discs (CDs), micro-drives and other disk storage media, Read-Only Memory (ROMs), Programmable Read-Only Memory (PROMs), Erasable Programmable Read-Only Memory (EPROMS), Electrically Erasable Programmable Read-Only Memory (EEPROMs), Random-Access Memory (RAMS), Video Random-Access Memory (VRAMs), Dynamic Random-Access Memory (DRAMs) and any type of media or device suitable for storing instructions and/or data.

FIG. 1 depicts elements of an exemplary system 100 for practicing an aspect of the present invention. A content source 105 may provide program and/or secondary content comprising one or more media objects to a principal-content receiver 110. When a media object comprising still-image, audio and/or video content is received at the principal-content receiver 110, either of, any two of, or all three of the still-image, the audio and the video content may be passed to a fingerprint generator 120, whereat one or more reference fingerprints associated with the media object may be generated according to a fingerprint-generation method known in the art. In alternative embodiments, a content source 105 may provide the one or more reference fingerprints directly to a principal-content receiver 110. The resulting one or more reference fingerprints may be stored in a fingerprint database 130. A unique fingerprint-media-object identifier may associate the one or more reference fingerprints with the media object from which they were generated. Content source 105 also may provide supplementary content to a supplementary-content receiver 140. The supplementary content may be stored in a supplementary-content database 150, along with a unique supplementary-content-media-object identifier that may associate the supplementary content with the media object. In some embodiments of the present invention, the unique fingerprint-media-object identifier used within the fingerprint database 130 to associate the one or more reference fingerprints with the media object from which they were generated may be the same as the unique supplementary-content-media-object identifier used within the supplementary-content database 150 to associate the supplementary content with the media object. In alternative embodiments, these identifiers may be distinct but associated with each other. The supplementary content may specify an action to be taken when media content is recognized in a broadcast stream 165 created from a program-stream source 160. Exemplary actions include providing a Universal Resource Locator (URL) of a related web page; presenting related web-page content; providing biographical information about an artist associated with the media content; providing performance schedule information, for example, future concert dates, future concert venues and other schedule information, about an artist associated with the media content; displaying images related to the media content; providing a playlist of related songs, movies and/or television episodes; providing coupons for related media content; providing a social-media tag, for example, a hash-tag and other social-media tags, related to the artist and/or media content; providing recent social-media content, for example, tweets related to the media content and/or artist; and posting the identity of the artist to a social-media website, for example, Facebook and other social-media websites. When the identified media content is one of several possible episodes of a unique television series, further exemplary

actions may include providing a schedule for future episodes of the series; playing related media content, for example, a promotion for the series and other related media content; creating record events to record future episodes of the series when broadcast; and creating reminder events to notify when future episodes of the series are broadcast.

A portion of the broadcast stream 165 may be monitored by a detector 170. The detector 170 may pass either of, any two of, or all three of the still-image content, the audio content and video content from the broadcast stream to the fingerprint generator 120. The resulting fingerprints generated from the broadcast stream may be compared with the one or more reference fingerprints from the fingerprint database 130. When a match is found, the detector 170 may produce a first control signal that may be passed to a controller 180, along with the unique fingerprint-media-object identifier associated with the matched reference fingerprint. Upon receiving the first control signal, the controller 180 may use the unique fingerprint-media-object identifier to extract supplementary content associated with the principal content from supplementary-content database 150, and the controller 180 may activate a multiplexer 190 to insert the extracted supplementary content into the broadcast stream 165, thereby producing an enhanced broadcast stream 195. In an exemplary embodiment, the supplementary content may be an interactive application associated with the primary content. Once a match has been found, the detector 170 continues to monitor the broadcast stream 165, generating fingerprints and comparing the generated fingerprints with the one or more reference fingerprints from the fingerprint database 130. When the detector 170 fails to find a match, the detector 170 may generate a second control signal that may be passed to the controller 180. Upon receiving the second control signal, the controller 180 may deactivate the multiplexer 190 to no longer insert the extracted supplementary content into the enhanced broadcast stream 195.

Exemplary system 100 in FIG. 1 incorporates detector 170 which performs a specific action upon recognition of primary content within program stream 165, namely communicating with controller 180 to accomplish the injection of supplementary content from database 150 into broadcast stream 165.

FIG. 2 depicts an alternative exemplary embodiment of a system 200 configured to practice an aspect of the present invention. In FIG. 2, controller 180 may perform an action through an external controller 198. The action may be any action relevant to the occurrence of recognized content within broadcast stream 165. For example, controller 180 may provide metadata to an external logging system upon recognition of a specific piece of content within broadcast stream 165, the metadata being retrieved from supplementary content database 150. The action performed through an external controller 198 may be specified by supplementary content stored in supplementary-content database 150.

Some instances of principal content may not allow for unique identification by system 100, 200. FIG. 3 shows an exemplary case of three media objects 300, 310, 320, two media objects 300, 310 that share a substantially identical introductory section, but differ in later portions of the content, and a third media object 320 differing from both other media objects 310, 320. In this example, media object A 300 comprises substantially identical introductory section 330, a first scene A1 331, and a second scene A2 332. Media object B 310 comprises substantially identical introductory section 330, a first scene B1 333, and a second scene B2 334. Because media object A 300 and media object B 310 share a substantially identical introductory section 330, any fingerprints generated from the substantially identical introductory section 330

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could not be used to differentiate between the two pieces of content **300**, **310**. This situation arises because a media identification system, when presented with the content of media object **300** or media object **310**, cannot determine whether introductory section **330** arises from media object A **300** or media object B **310**, and so may provide a multiple identification naming both media object A **300** and media object B **310**. However, the fingerprints for the substantially identical introductory section **330** could be used to differentiate either media object A **300** or media object B **310** from media object C **320**, which comprises a first scene C1 **340** and a second scene C2 **341**.

In accordance with an aspect of the present invention, an embodiment of exemplary system **100** may receive two or more media objects **300**, **310** comprising principal content, the initial content portion **330** of which is substantially identical among the two **300**, **310** or more media objects, wherein the two or more media objects **300**, **310** may be associated with a single instance of supplementary content received at supplementary content receiver **140**. The two or more media objects **300**, **310** may be provided to the fingerprint generator **120**, and the resulting sets of one or more reference fingerprints may be stored in fingerprint database **130**. The commonly-associated supplementary content may be stored in supplementary content database **150** and may be associated with each of the two or more unique fingerprint-media-object identifiers used within the fingerprint database **130** to identify the two or more sets of one or more fingerprints generated from the two or more media objects **300**, **310**. In this embodiment, detector **170** may receive a portion of broadcast stream **165**, pass either of, any two of, or all three of still-image content, audio content and video content from the broadcast stream to the fingerprint generator **120**, and compare the resulting fingerprints with the two or more sets of one or more reference fingerprints from the fingerprint database **130**. Detector **170** may find a multiple match, wherein the resulting fingerprints match reference fingerprints from two or more sets of reference fingerprints. Detector **170** may provide the multiple match data to controller **180**, and controller **180** may use the two or more unique fingerprint-media-object identifiers to determine that supplementary content database **150** contains a single instance of supplementary content associated with all of the two or more unique fingerprint-media-object identifiers. In this circumstance, controller **180** may activate a multiplexer **180** to insert the extracted supplementary content into the broadcast stream **165**, thereby producing an enhanced broadcast stream **195**. In an exemplary embodiment, the supplementary content may be an interactive application appropriate to each of the two or more media objects **300**, **310**. In an alternative embodiment **200**, controller **180** may perform an action appropriate to the two or more unique fingerprint-media-object identifiers through an external controller **198**.

Once a multiple match has been found, the detector **170** may continue to monitor the broadcast stream **165**, generating fingerprints and comparing the generated fingerprints with the two or more sets of one or more reference fingerprints from the fingerprint database **130**. During this period, detector **170** may find single or multiple matches within the two or more sets of one or more reference fingerprints from the fingerprint database **130**. When the detector **170** fails to find any match, the detector **170** may generate a second control signal that may be passed to the controller **180**. Upon receiving the second control signal, the controller **180** may deactivate the multiplexer **190** to no longer insert the extracted supplementary content into the enhanced broadcast stream **195**.

As an example of how the system **100** of FIG. **1** or the system **200** of FIG. **2** might be utilized, a multiple systems operator (MSO) may desire to distribute an interactive application on a broadcast channel whenever one of a series of promotional commercials is aired. The schedule for airing the commercials may not be known to the MSO. The system **100** may be deployed in the MSO central distribution center, where a broadcast stream may be monitored to identify when content from one of the series of promotional commercials occurs. Some of the commercials may share a substantially identical introductory section, whereas others of the commercials may be entirely unique in their content. When the broadcast stream content is fingerprinted and the fingerprints forwarded to a fingerprint detector **170**, multiple or single matches may be found, depending on whether a specific commercial being aired does or does not share substantially identical content with other commercials in the set. Regardless of whether multiple or single matches are found, the same interactive application may be incorporated into the broadcast stream for reception and execution at viewer premises. The current invention accomplishes this task as described herein.

The systems **100**, **200** depicted in FIG. **1** and FIG. **2** are intended to be exemplary, and one skilled in the art will recognize that many details and aspects of systems **100**, **200** could be modified or altered without departing from the spirit and scope of the present invention. For example, in some embodiments of the present invention, principal content and supplementary content may come from the same source **105**. In alternative embodiments, principal content and supplementary content may come from different sources (not shown). In some embodiments of the present invention, principal content and/or supplementary content may be received in tangible form. In alternative embodiments, principal and/or supplementary content may be received in intangible and evanescent form. In some embodiments of the present invention, content may be transported via physical media, for example, tape, disk, memory card, and other physical transportation means. In alternative embodiments of the present invention, content may be provided as evanescent digital or analog signals transmitted via wired or wireless communication means.

In some embodiments of the present invention, the fingerprint generator **120** may be realized as a single system accessible to both the principal-content receiver **110** and the detector **170**. In alternative embodiments of the present invention (not shown), the fingerprint generator **120** may be realized as two separate implementations of fingerprint generator instances operating at different locations. In some embodiments of the present invention, the process of generating and storing reference fingerprints may occur at a time and/or place distinct from the time and/or place of the operation of the detector **170**. The reference fingerprint database **130** for storing reference fingerprints may be implemented as a flat file stored on a physical medium, as a relational database implemented on a central server computer, as a virtual database implemented using cloud storage techniques, or by other equivalent methods well known in the art. Similarly, the supplementary-content database **150** may be implemented as a flat file, as a relational database, as a virtual database, or by other data storage and retrieval means well known in the art. In some embodiments of the present invention, the principal-content receiver **110** and supplementary-content receiver **140** may be realized as a single module. In alternative embodiments, the principal-content receiver **110** and the supplementary-content receiver **140** may be realized as separate modules. In some embodiments of the present invention, the fingerprint database **130** and the supplementary-content data-

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base **150** may be realized as separate databases. In alternative embodiments of the present invention, the fingerprint database **130** and the supplementary-content database **150** may be realized as a single database. The unique identifier associated with principal content and supplementary content may be provided by content source **105**, or may be generated by principal content receiver **110**, by supplementary content receiver **140**, or by a separate unique identifier generator (not shown).

In some embodiments of the present invention, the program-stream source **160** may be a singular entity. In alternative embodiments, the program-stream source **160** may be multiple entities, each providing one or more content streams. The program stream **165** may be communicated via a wired or wireless network, and the program stream **165** may be communicated in digital or analog representation. The detector **170** and the controller **180** may be located in proximity to, or distant from, the program stream source **160**, and/or the multiplexer **190**, and/or each other. Monitoring of the program stream **165** may be performed by any of the well-known monitoring means known in the art, for example, electronic sampling; reception of unicast, multicast, or broadcast internet protocol traffic on a wired or wireless digital network; antenna reception of wireless electromagnetic signals; and other means known in the art. Communication between the detector **170** and the controller **180**, and between the controller **180** and the multiplexer **190**, may be by any conventional wired or wireless means known in the art.

While FIG. **1** and FIG. **2** depict only a single instance of each element of system **100**, **200** this is not a limitation of the present invention. In alternative embodiments, other system topologies may be utilized that fall within the spirit and scope of the present invention. For example, a principal-content receiver **110** may communicate with multiple fingerprint generators (one shown) **120**; likewise, multiple principal-content receivers (one shown) **110** may communicate with a single fingerprint generator **120**. A principal-content receiver **110** may store fingerprints in multiple fingerprint databases (one shown) **130**; likewise, multiple principal-content receivers (one shown) **110** may store fingerprints in a single fingerprint database **130**. A supplementary-content receiver **140** may store supplementary content in multiple supplementary-content databases (one shown) **150**; likewise, multiple supplementary-content receivers (one shown) **140** may store supplementary content in a single supplementary-content database **150**. A detector **170** may communicate with a multiple fingerprint generators (one shown) **120**; likewise multiple detectors (one shown) **170** may communicate with a single fingerprint generator **120**. A detector **170** may communicate with multiple fingerprint databases (one shown) **130**; likewise, multiple detectors (one shown) **170** may communicate with a single fingerprint database **130**. A controller **180** may communicate with multiple supplementary-content databases (one shown) **150**; likewise, multiple controllers (one shown) **180** may communicate with a single supplementary-content database **150**. A detector **170** may monitor multiple program streams (one shown) **165**; likewise, multiple detectors (one shown) **170** may monitor a single program stream **165**. A detector **170** may communicate with a multiple controllers (one shown) **180**; likewise, multiple detectors (one shown) **170** may communicate with a single controller **180**. A controller **180** may communicate with multiple multiplexers (one shown) **190**; likewise multiple controllers (one shown) **180** may communicate with a single multiplexer **190**. The insertion of supplementary content may be performed multiple times on a single program stream, in parallel, in series, or as a combination of series and parallel operations. A controller **180** may communicate with multiple external controllers (one shown) **198**; likewise, multiple controllers (one shown) **180** may communicate with a single external controller **198**. The foregoing list is not intended to be exhaustive of the possible alternative embodiments of system **100**, but is exemplary of a range of implementations that fall within the spirit and scope of the present invention.

FIG. **4** depicts a flowchart of an exemplary process **400**, according to embodiments of the present invention, to be executed in a detector **170** of exemplary system **100**, **200**. At a step **410**, the detection module may be initialized. At a further step **420**, samples may be extracted from a broadcast stream **165**, and a fingerprint may be generated from the samples, for example, by means of a fingerprint generator **120**. The samples may be taken, for example, from a still-image stream, from a video stream, from an audio stream, or from both video and audio streams. The fingerprints, for example, may be computed from and may represent a single field of video, a single frame of video, a series of sequential audio samples, or other data taken from the broadcast stream. At a further step **430**, the generated fingerprint may be compared with a plurality of reference fingerprints, for example, those extracted from a fingerprint database **130**. At a further step **440**, a determination may be made whether the generated fingerprint matches a reference fingerprint. If no match is found **442**, execution may return to a step **420**.

If at a step **440** a match is found **444**, at a further step **450** a determination may be made whether the match is a single match. If the match is a single match **454**, at a further step **460** an action that is associated with the single match may be selected. If at a step **450**, a multiple match is found **452**, at a further step **470**, a determination may be made whether a common action is associated with all the multiple matches found at a step **430**. If a common action is not associated with all the multiple matches **472**, execution may return to a step **420**. If a common action is associated with all the multiple matches **474**, at a further step **480**, an action that is associated with all the multiple matches may be selected. Following selection of an action at a step **460** or a step **480**, at a step **490**, a selected action may be performed. Following performance of the selected action at a step **490**, execution may return to a step **420**.

The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding equivalence of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A method for monitoring a media stream and selecting an action, the method comprising:

prior to receiving a media stream:

receiving a plurality of media objects, each media object comprising a temporally first-received initial content section that is substantially identical to the temporally first-received initial content section of each of the other media objects in the plurality of media objects and a subsequently received content section unique to the each media object; and

associating an action with the plurality of media objects;

receiving a media stream comprising one of the plurality of media objects;

detecting that the media stream comprises the substantially identical initial content section; and

selecting the action associated with the plurality of media objects.

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2. The method of claim 1, the method further comprising: performing the selected action.

3. The method of claim 1, the method further comprising:
creating a set of reference fingerprints for each of the media objects in the plurality of media objects, thereby producing a plurality of reference-fingerprint sets;
associating a unique fingerprint-media-object identifier with each of the plurality of media objects;
adding each reference-fingerprint set in the plurality of reference-fingerprint sets to a fingerprint database;
providing the fingerprint database to a fingerprint identifier;
generating a fingerprint from a portion of the content of the received media stream;
transmitting the fingerprint to the fingerprint identifier; and
receiving from the fingerprint identifier a response comprising a plurality of fingerprint-media-object identifiers identifying each of the media objects in the plurality of media objects.

4. The method of claim 1, the method further comprising:
receiving a first media object, the first media object not sharing any substantially identical content with the media objects in the plurality of media objects;
associating a first action with the first media object;
receiving a second media stream comprising the first media object;
detecting that the second media stream comprises the first media object; and
selecting the first action.

5. The method of claim 4, the method further comprising:
creating a set of reference fingerprints for the first media object;
associating a unique first fingerprint-media-object identifier with the first media object;
adding the set of reference fingerprints to a fingerprint database;
providing the fingerprint database to a fingerprint identifier;
generating a fingerprint from a portion of the content of the received second media stream;
transmitting the fingerprint to the fingerprint identifier; and
receiving from the fingerprint identifier a response comprising the first fingerprint-media-object identifier identifying the second media object.

6. The method of claim 1, wherein the action is an action selected from the group consisting of providing a URL of a related web page, presenting a related web-page content, providing a biographical information about an artist, providing a performance-schedule information, displaying an image, providing a playlist, providing a coupon, providing a social-media tag, providing a recent social-media content, posting an identity of an artist to a social-media website, providing a schedule for a future episode of a television series, playing a related media content, creating a record event to record a future episode of a television series and creating a reminder event to notify when a future episode of a television series is broadcast.

7. A method for monitoring a media content and selecting an action, the method comprising:
receiving a media stream;
generating a fingerprint from a portion of the content of the media stream;
transmitting the fingerprint to a media identifier system;
receiving from the media identifier system a response comprising a plurality of fingerprint-media-object identifiers associated with a plurality of media objects, wherein a

reference fingerprint associated with each media object in the plurality of media objects substantially matches the fingerprint; and
selecting an action based on the plurality of fingerprint-media-object identifiers.

8. The method of claim 7, the method further comprising: performing the selected action.

9. The method of claim 7, wherein the selected action is an action selected from the group consisting of providing a URL of a related web page, presenting a related web-page content, providing a biographical information about an artist, providing a performance-schedule information, displaying an image, providing a playlist, providing a coupon, providing a social-media tag, providing a recent social-media content, posting an identity of an artist to a social-media website, providing a schedule for a future episode of a television series, playing a related media content, creating a record event to record a future episode of a television series and creating a reminder event to notify when a future episode of a television series is broadcast.

10. The method of claim 7, wherein the selecting an action based on the plurality of fingerprint-media-object identifiers comprises:
using each fingerprint-media-object identifier in the plurality of fingerprint-media-object identifiers to determine an associated supplementary content; and
when each of the associated supplementary contents is a single instance of supplementary content, selecting the action based on the single instance of supplementary content.

11. The method of claim 10 further comprising:
inserting the single instance of supplementary content into the received media stream,
thereby producing an enhanced broadcast stream.

12. The method of claim 10, wherein the selected action is an action specified in the single instance of supplementary content.

13. A system for monitoring a media stream and selecting an action, the system comprising:
a media object receiver module configured to receive a plurality of media objects comprising at least one of still-image content, audio content and video content, each media object comprising a temporally first-received initial content section that is substantially identical to the temporally first-received initial content section of each of the other media objects in the plurality of media objects and a subsequently received content section unique to the each media object;
an association module configured to associate an action with the plurality of media objects;
a media stream receiver module configured to receive a media stream comprising one of the plurality of media objects;
a detector module configured to detect that the media stream contains at least the the substantially identical initial content section; and
a selector module configured to select an action associated with each of the plurality of media content.

14. The system of claim 13, further comprising:
an execution module configured to perform the selected action.

15. The system of claim 13, wherein the action is an action selected from the group consisting of providing a URL of a related web page, presenting a related web-page content, providing a biographical information about an artist, providing a performance-schedule information, displaying an image, providing a playlist, providing a coupon, providing a

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social-media tag, providing a recent social-media content, posting an identity of an artist to a social-media website, providing a schedule for a future episode of a television series, playing a related media content, creating a record event to record a future episode of a television series and creating a reminder event to notify when a future episode of a television series is broadcast.

16. The system of claim 13, further comprising:

an identifier module configured to assign a unique fingerprint-media-object identifier to a media object.

17. The system of claim 16, the system further comprising:

a fingerprint module configured to compute a plurality of reference fingerprints from the content of a media object; and

a first database module configured to:

receive the plurality of reference fingerprints and the unique fingerprint-media-object identifier;

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associate the plurality of reference fingerprints and the unique fingerprint-media-object identifier, and

store and retrieve the plurality of reference fingerprints, the unique fingerprint-media-object identifier, and the association between the plurality of reference fingerprints and the unique fingerprint-media-object identifier;

wherein the detector module is further configured to:

generate a first fingerprint from at least one of a received still-image content, a received audio content and a received video content in the media stream;

compare the first fingerprint with the plurality of reference fingerprints retrieved from the first database module; and

determine whether the first fingerprint matches one or more fingerprints in the plurality of reference fingerprint.

*   *   *   *   *

Exhibit C

(12) **United States Patent**
Wallace et al.

(10) **Patent No.:** **US 7,260,782 B2**
(45) **Date of Patent:** **Aug. 21, 2007**

(54) **METHOD AND SYSTEM FOR GENERATING FLEXIBLE TIME-BASED CONTROL OF APPLICATION APPEARANCE AND BEHAVIOR**

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(73) Assignee: **Ensequence, Inc.**, Portland, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 888 days.

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(22) Filed: **Apr. 30, 2003**

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(51) **Int. Cl.**
G11B 27/00 (2006.01)
(52) **U.S. Cl.** **715/716**
(58) **Field of Classification Search** 715/716
See application file for complete search history.

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(57) **ABSTRACT**

A method, a computer readable medium, and a system are provided for generating control information for controlling computer system operation during execution of the computer system. At least one attribute change of a computer system to occur during execution of the computer system is identified. The attribute change is associated with an event taking place during computer system execution. An index point is created identifying the attribute point as triggering the attribute change, and the index point is associated with the attribute change in the computer system. The index point is stored in a format configured to be used by the computer system to initiate the attribute change upon the index point being reached during the execution of the computer system.

36 Claims, 7 Drawing Sheets

Fig. 1

Fig. 2A

Fig. 2B
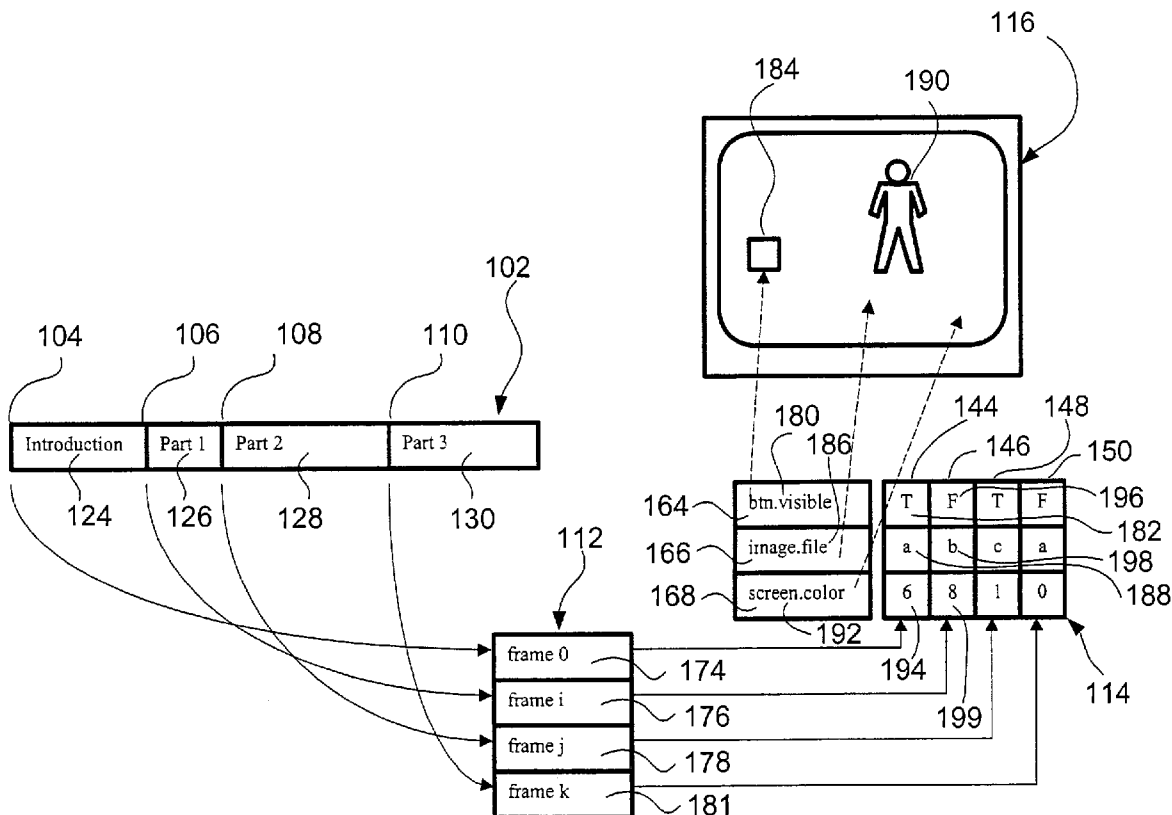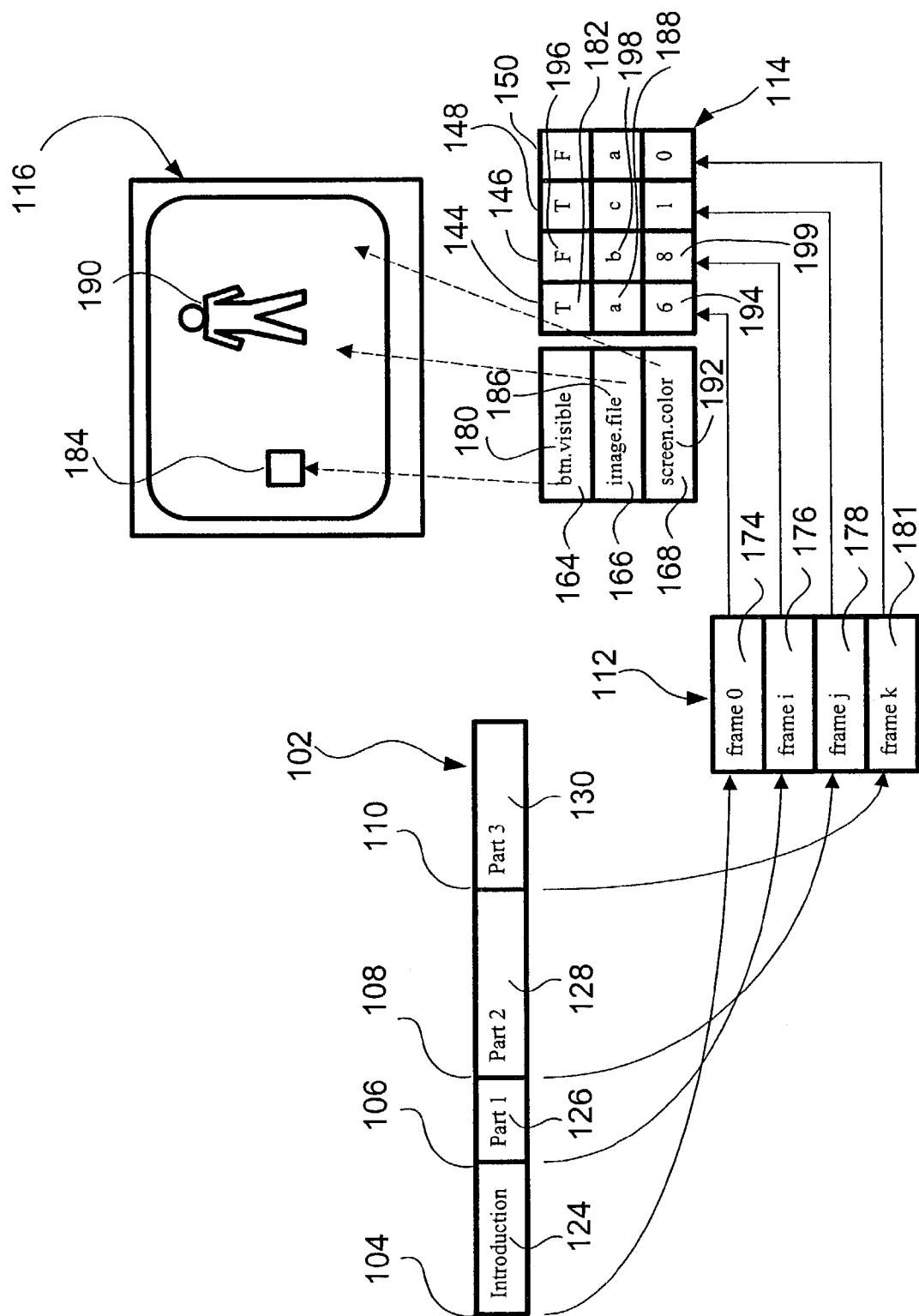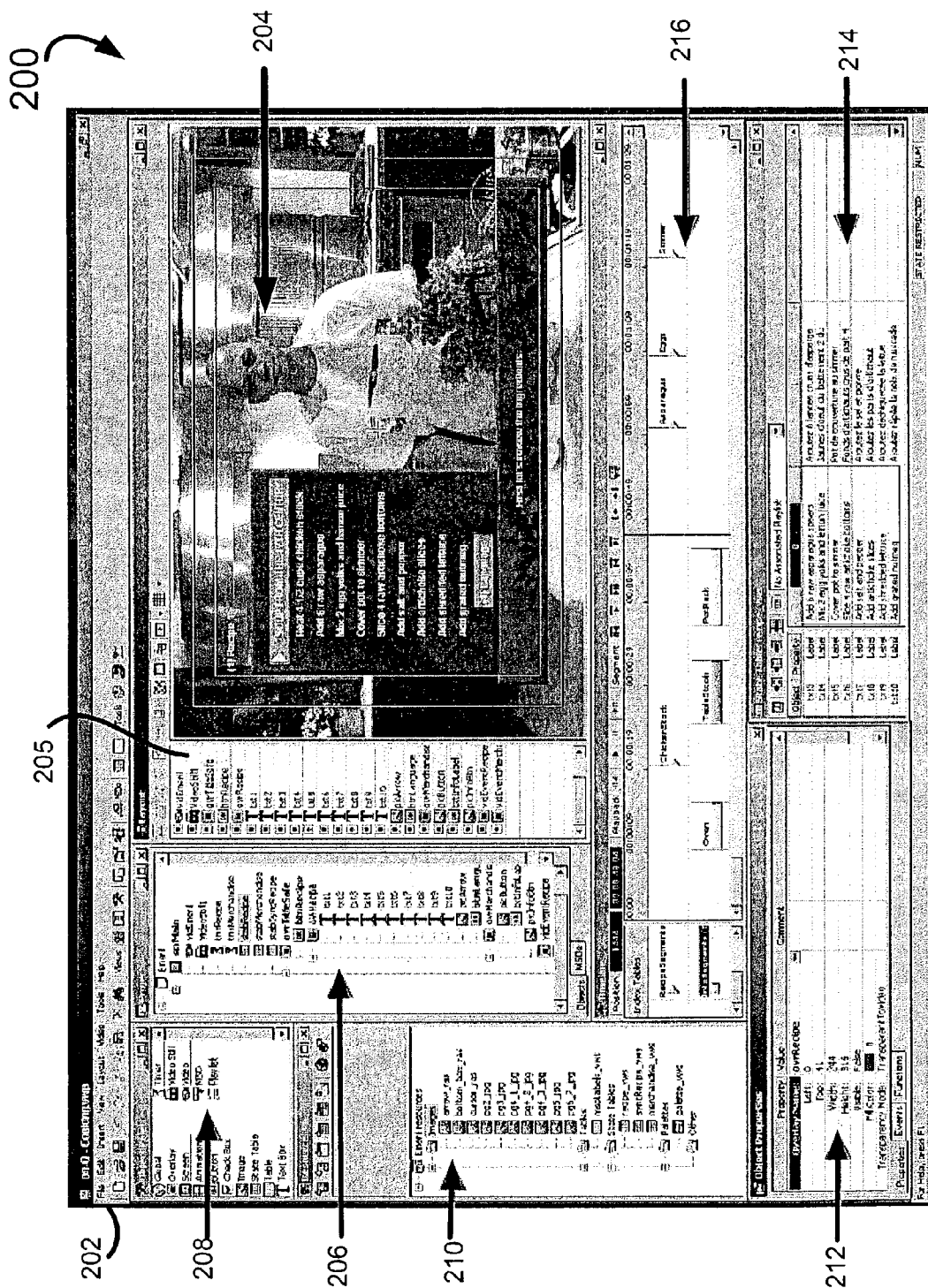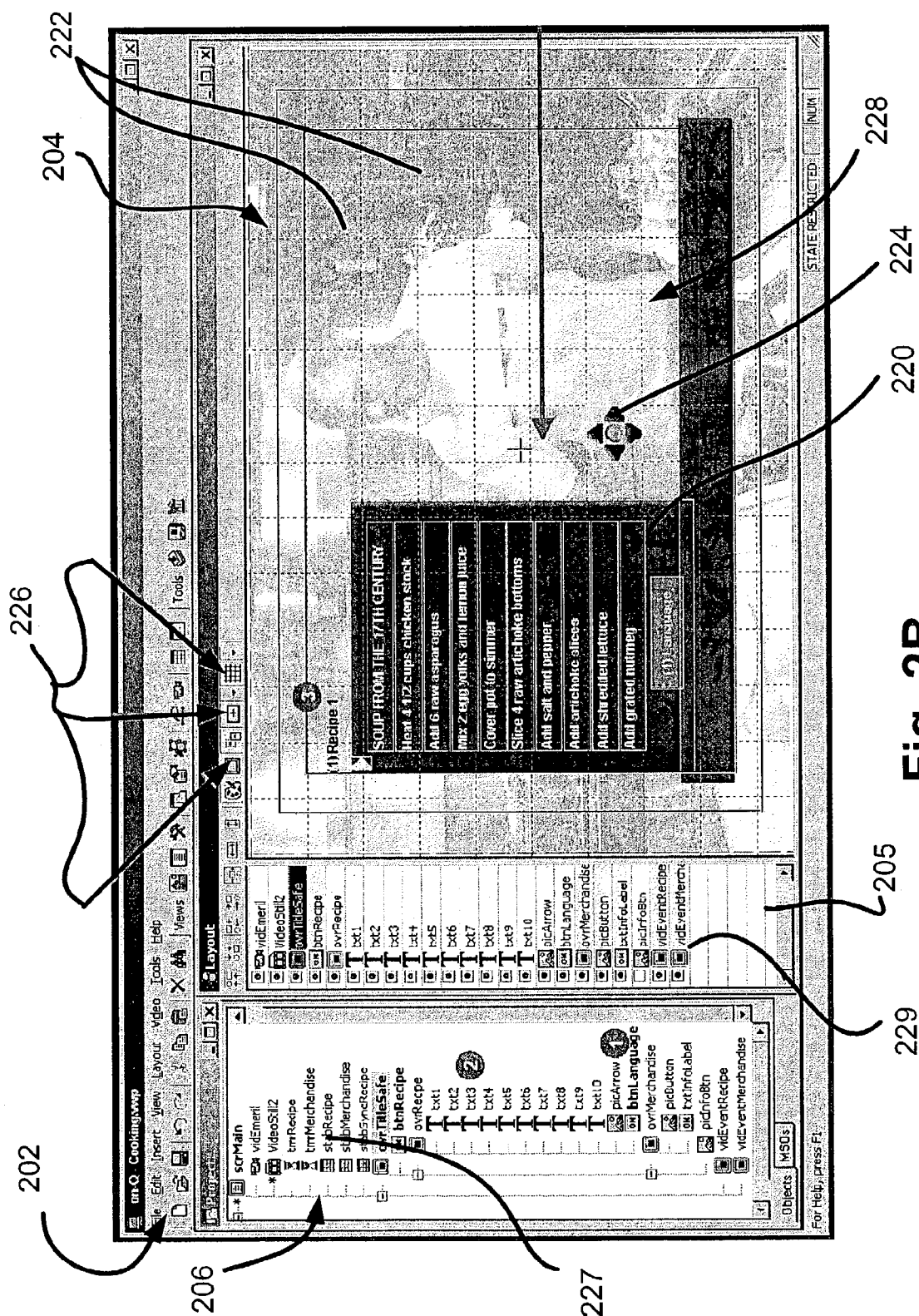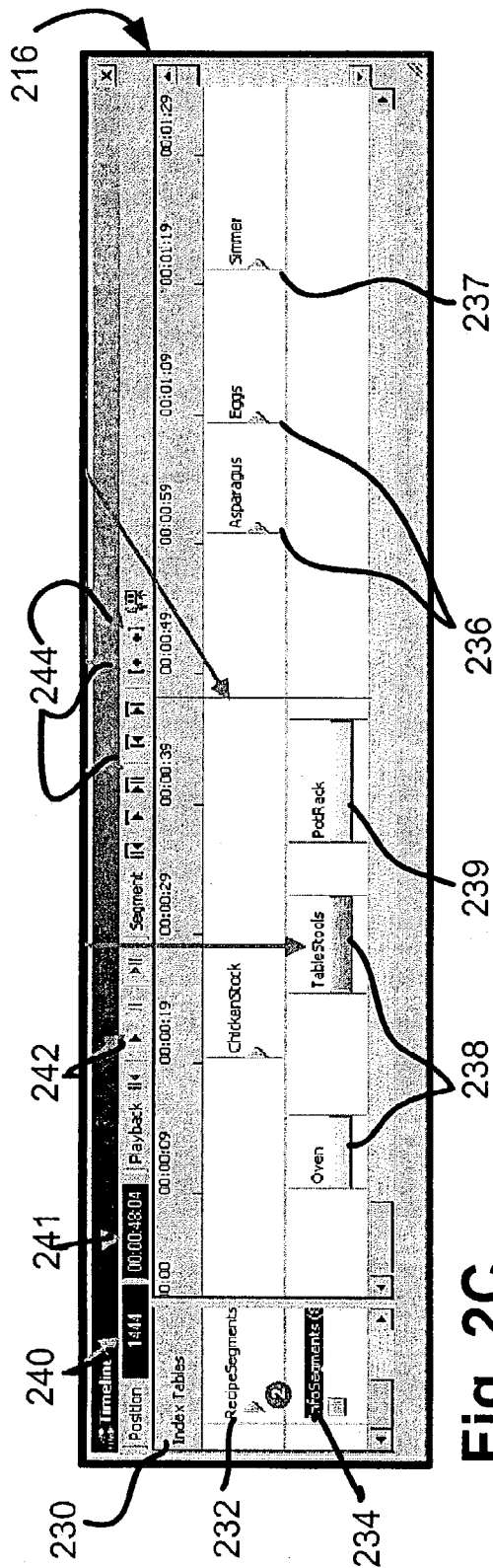
Fig. 2C
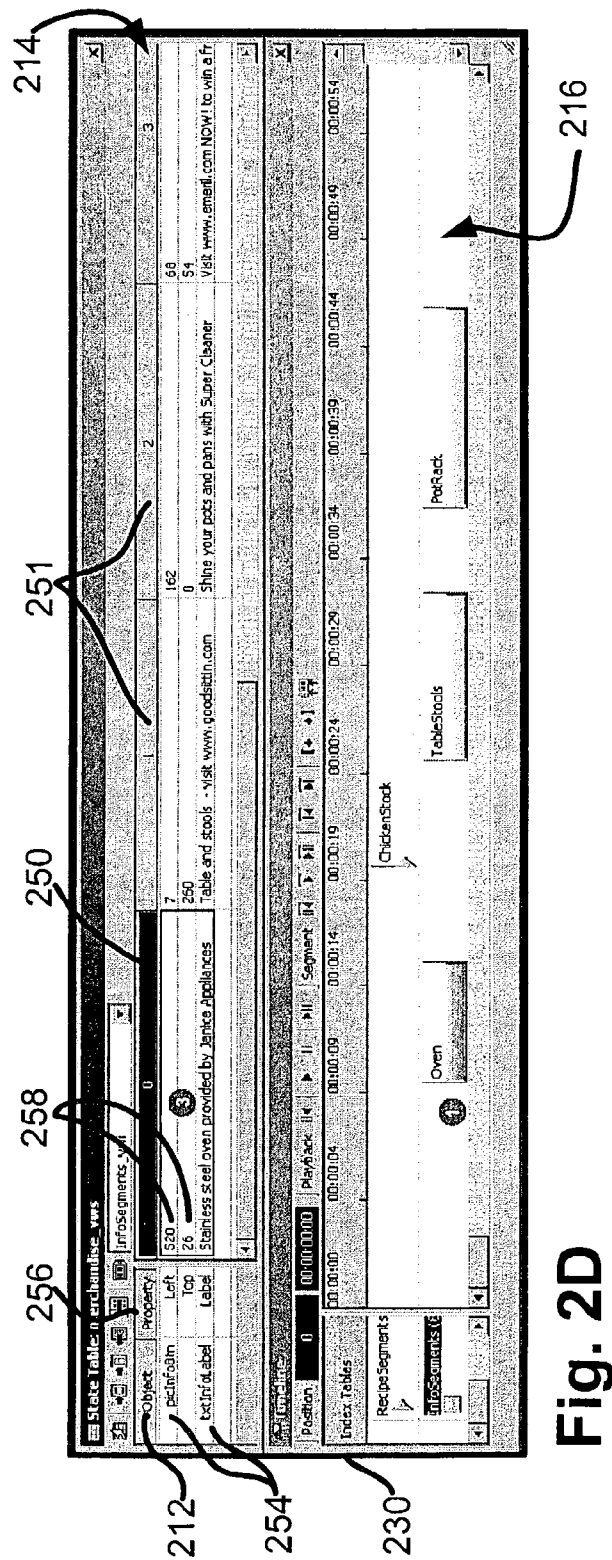
Fig. 2D
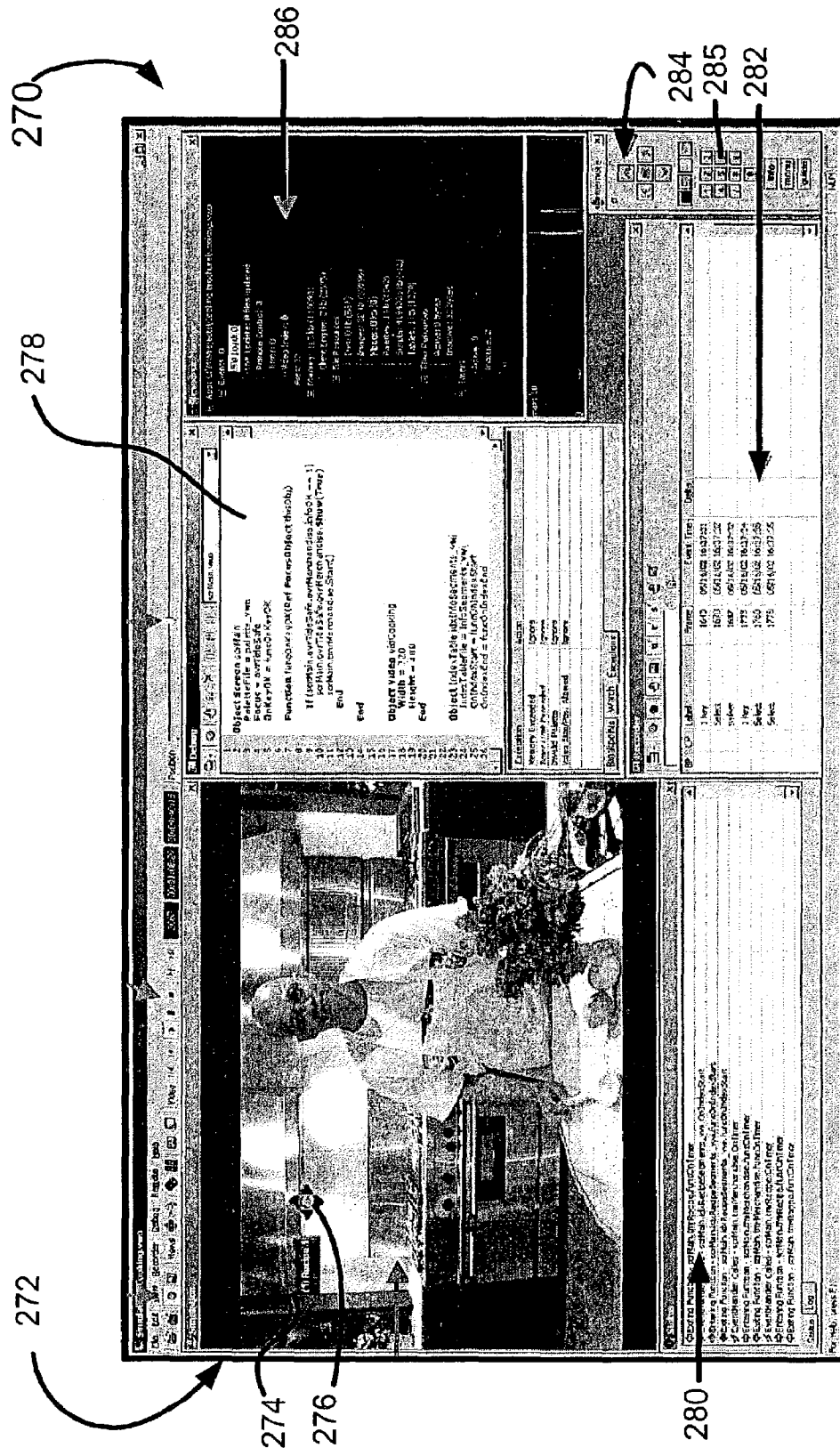
Fig. 2E
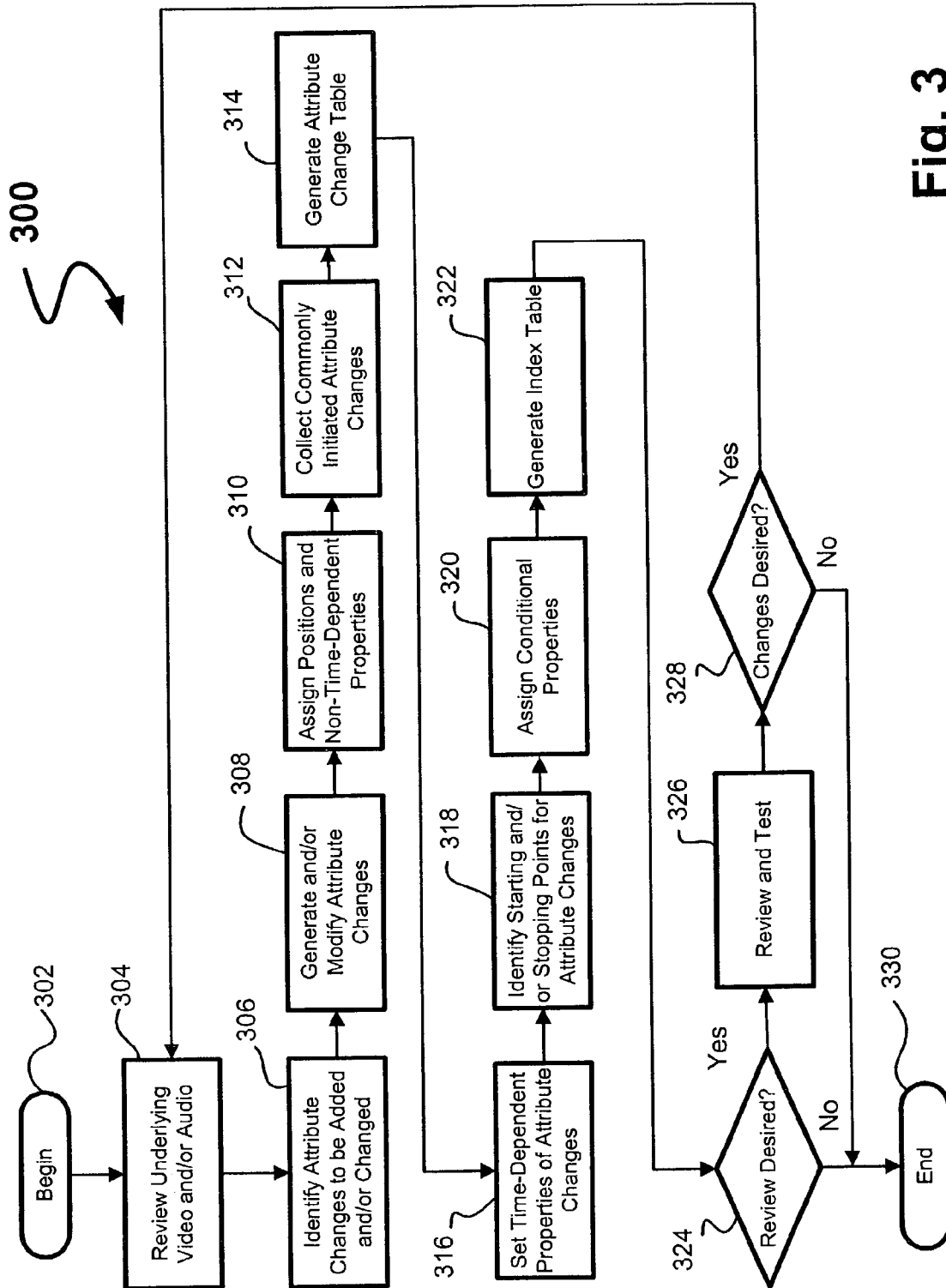
Fig. 3
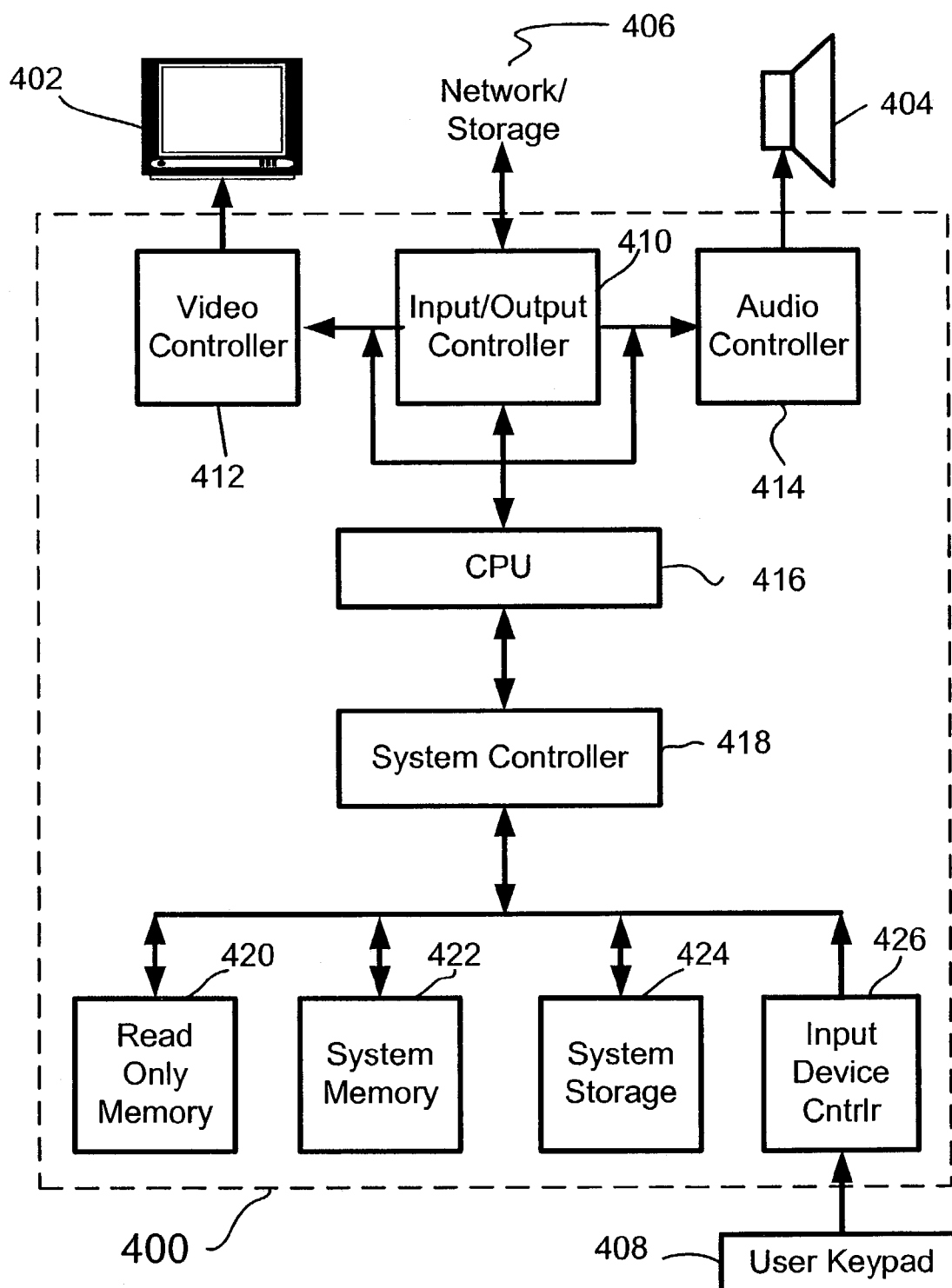
Fig. 4

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METHOD AND SYSTEM FOR GENERATING FLEXIBLE TIME-BASED CONTROL OF APPLICATION APPEARANCE AND BEHAVIOR

PRIORITY CLAIM

This invention claims priority from U.S. Provisional Application No. 60/395,655, entitled "METHOD AND SYSTEM FOR FLEXIBLE TIME-BASED CONTROL OF APPEARANCE AND BEHAVIOR OF SOFTWARE APPLICATION," filed Jul. 12, 2002.

RELATED APPLICATIONS

This patent application is related to concurrently-filed patent applications entitled "METHOD AND SYSTEM FOR AUTOMATIC CONTROL OF GRAPHICAL COMPUTER APPLICATION APPEARANCE AND EXECUTION," bearing Ser. No. 10/427,735, "METHOD AND SYSTEM FOR FLEXIBLE TIME-BASED CONTROL OF APPEARANCE AND BEHAVIOR OF SOFTWARE APPLICATION," bearing Ser. No. 10/427,343, and "METHOD AND SYSTEM FOR PROVIDING FLEXIBLE TIME-BASED CONTROL OF APPLICATION APPEARANCE AND BEHAVIOR," bearing Ser. No. 10/427,255, all of which are incorporated by reference.

FIELD OF THE INVENTION

This invention relates generally to computer software applications and, more specifically, to timing, control, and development of software applications.

BACKGROUND OF THE INVENTION

The improved price-performance of digital technology has made possible the advent of digital media broadcasting. The reduced cost of microprocessors, digital memory, and related devices has made it possible to place computers in set-top boxes (STBs) and related devices to receive digital cable or digital satellite television signals and decode those signals into audio-visual programs.

The advent of digital television broadcasting and the proliferation of STBs also makes it possible to enhance viewers' television experiences. In addition to transmitting video and audio data, digital media broadcasting allows additional data to be transmitted to the STBs with which users can interact. By analogy, users can interact through an STB with data transmitted via the digital media broadcast the way a computer user can interact with data available over the Internet. For example, digital television subscribers are already acquainted with an electronic program guide (EPG) function which enables users to select and tune to particular programs and/or read about the programs being shown at present or at later points in time.

The EPG is a rudimentary example of an interactive television application exploiting the capability of the digital broadcast medium to transmit additional content and for the STB to execute this additional content. The computer functionality of STBs also makes other interactive television applications possible. With appropriately configured STBs, users potentially can play along with game shows, take tests in on-line distance learning courses, bid in on-line auctions, and otherwise actively engage the content being broadcast. STBs thus allow users to have highly interactive television experiences.

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One type of additional content application which is desirable in such a broadcast environment is one which provides functionality synchronized with video or audio content on a broadcast channel. In the examples of interactive game shows, on-line distance learning testing, and on-line auctions, it would be highly desirable to provide application-specific behaviors in an STB which are correlated to associated video and audio streams being broadcast. Providing application-specific behaviors in the STB and correlating the application-specific behaviors with video and audio streams presents a number of concerns. These concerns and conventional responses to these concerns are described in detail in the co-pending patent applications incorporated by reference. Nonetheless, at least some of these concerns merit repeating.

First, synchronizing behaviors of the application specific programming with a series of events in the video and audio data can be difficult. Applications of this type conventionally use asynchronous trigger signals embedded in the broadcast signal. These asynchronous trigger signals can be difficult to deliver accurately when data blocks carrying such triggers must be multiplexed with so much other video and audio data transmitted in the medium. Further, these time-dependencies present particular concerns when a user engages a program already in progress and may have missed a timing synchronization event at the outset of the program. Correlating the application-specific programming with the video and audio stream may be troublesome, if even possible.

Second, providing application specific behaviors to STBs conventionally involves transmitting application-specific program code to the STBs. The transmission would be carried through the digital broadcast medium, just as video and audio data are transmitted. Downloading such applications involves transmitting potentially many data packets, comprising vast numbers of data blocks, for each application. A concern arises because video and audio data for the numerous channels being transmitted leaves little bandwidth for other data. Thus, it may be difficult to procure the bandwidth necessary to transmit large bodies of application specific programming to support desired behaviors in STBs. Moreover, STBs may have relatively little random access memory (RAM) in which to store significant applications.

Third, and potentially more troubling, is that creating interactive programming conventionally involves programmers having to write application code specific to each program. Writing, testing, and debugging application code for each episode of a program is time- and labor-intensive. It may be difficult to generate application code correlated to underlying video and audio content in time to meet programming schedules. Also, having skilled programmers and software engineers capable of writing the application code is likely to be expensive. Each of these concerns is magnified in light of the concerns with timing synchronization and the need to generate short, efficient code to minimize bandwidth demands as previously described.

Thus, there are unmet needs in the art for methods and systems for efficiently developing interactive content and for generating appropriately synchronized applications which can be communicated to STBs and other user facilities without overwhelming available bandwidth capacities.

SUMMARY OF THE INVENTION

Embodiments of the present invention provide for developing control information for controlling appearance and behavior during execution of a computer system. A user monitoring a video and/or audio program can identify

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attributes to be added, changed, and deleted during execution of the program, and can establish timing for the presentation or removal of these attributes. The control information is collected into a format which can be used by a computer system to execute the attributes generated and sequenced by embodiments of the present invention together with the composite video and audio program. Taking advantage of a simplified environment provided for generating the control information, such as a graphical user interface-driven environment, embodiments of the present invention allow control information governing behavior of a computer system during computer system execution to be generated without writing computer program code. Accordingly, control information for controlling computer system execution can be created by designers as well as or instead of computer programmers. In addition, embodiments of the present invention allow for creation and changing of attributes which can be disseminated in real-time using broadcast facilities or another network.

More specifically, embodiments of the present invention provide a method, a computer readable medium, and a data system for generating control information for controlling computer system operation during execution of the computer system. Using embodiments of the present invention at least one attribute change of a computer system to occur during execution of the computer system is identified. The attribute change is associated with an event taking place during computer system execution. An index point is created identifying the attribute point as triggering the attribute change, and the index point is associated with the attribute change in the computer system. The index point is stored in a format configured to be used by the computer system to initiate the attribute change upon the index point being reached during the execution of the computer system.

Embodiments of the present invention suitably collect index points associated with the attribute change in an index table. The index table can have a number of columns listing events triggering attribute changes and other characteristics that determine, for example, whether the attribute change associated with the index point will be initiated if the execution of the computer system commenced after an event associated with the index point has been reached. If desired, attribute changes can be collected in a state table in which attribute changes occurring at a common point are grouped into a common state change. The state table can be configured such that as each state change is reached, the attributes collected in that state change are automatically triggered. The attribute change and index point information can be separately stored, revised, and loaded. The attribute change and index point information also can be correlated with an underlying program such that attribute changes are correlated with the underlying program.

In accordance with further aspects of the invention, an authoring environment is provided allowing a program author to observe the underlying program while either creating the attribute change or associating the attribute change with the event taking place during the execution of the computer program. The authoring environment allows the author to review and modify attribute changes as well as association of the attribute change with index points associating the attribute change with events transpiring during program execution. Thus, the authoring environment can allow simulation of a computer environment in which the program will be executed to review operation of the attribute changes.

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BRIEF DESCRIPTION OF THE DRAWINGS

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIG. 1 shows a timeline of event triggers driving an index table and a state table for controlling an interactive software application according to an embodiment of the present invention;

FIG. 2A is a screen shot from a development environment for developing interactive programming in accordance with an embodiment of the present invention;

FIG. 2B is a set of windows of the development environment shown in FIG. 2A for developing attribute changes;

FIG. 2C is a set of windows of the development environment shown in FIG. 2A for developing index points for controlling attribute changes;

FIG. 2D is a set of windows of the development environment shown in FIG. 2A for developing an attribute change table interacting with the set of index points;

FIG. 2E is a set of windows for reviewing and revising attribute changes and index points;

FIG. 3 is a flowchart for developing attribute changes according to an embodiment of the present invention; and

FIG. 4 is a block diagram of a data processing/media control system for generating applications and attribute changes according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE
INVENTION

By way of overview, embodiments of the present invention provide a method, a computer readable medium, and a data system for generating control information for controlling computer system operation during execution of the computer system. Using embodiments of the present invention at least one attribute change of a computer system to occur during execution of the computer system is identified. The attribute change is associated with an event taking place during computer system execution. An index point is created identifying the attribute point as triggering the attribute change, and the index point is associated with the attribute change in the computer system. The index point is stored in a format configured to be used by the computer system to initiate the attribute change upon the index point being reached during the execution of the computer system.

FIG. 1 shows exemplary interaction between a video timeline 102 for a program with identified events 104, 106, 108, and 110, an index table 112, a plurality of attribute changes collected as state changes in a state table 114, and a program display 116 that can be generated by one embodiment of the invention that by way of a non-limiting example. The operation of the state changes stored in the state table 114, the operation of the index points contained in the index table 112, and a facility for executing information contained in such tables are further described in the concurrently-filed, co-pending patent applications entitled "METHOD AND SYSTEM FOR AUTOMATIC CONTROL OF GRAPHICAL COMPUTER APPLICATION APPEARANCE AND EXECUTION," bearing Ser. No. 10/427,735, "METHOD AND SYSTEM FOR FLEXIBLE TIME-BASED CONTROL OF APPEARANCE AND BEHAVIOR OF SOFTWARE APPLICATION," bearing Ser. No. 10/427,343, and "METHOD AND SYSTEM FOR PROVIDING FLEXIBLE TIME-BASED CONTROL OF APPLICATION APPEARANCE AND BEHAVIOR," bearing Ser. No. 10/427,255,

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respectively, the contents of which are hereby incorporated by reference. Information such as that manifested in the tables **112** and **114** for controlling execution of the computer suitably are generated by embodiments of the present invention.

The video timeline **102** depicts four sequences in the program, including an introduction **124**, Part **1 126**, Part **2 128**, and Part **3 130**. The beginnings of these sequences **124**, **126**, **128**, and **130** are identified as events **104**, **106**, **108**, and **110**, respectively, to be used in correlating presentation of additional content. The events **104**, **106**, **108**, and **110** are thus associated with index points **174**, **176**, **178**, and **181** and collected in the index table **112** in sequential order. In turn, each of the index points **174**, **176**; **178**, and **181** are associated with a state **144**, **146**, **148**, and **150**, respectively, in the state table **114**. The state table **114** also lists three program attributes **164**, **166**, and **168** which control appearance and behavior of the program as shown on the program display **116**. As a result, as the video timeline **102** progresses with presentation of the program, each of the events **104**, **106**, **108**, and **110** are reached. Reaching each of these events **104**, **106**, **108**, and **110** triggers index points **174**, **176**, **178**, and **181**, respectively, in the index table **112**. Reaching index points **174**, **176**, **178**, and **181** in the index table **112** triggers state changes to states **144**, **146**, **148**, and **150**, respectively, thereby potentially changing each of the program attributes appearing on the program display **116**.

More specifically, as represented on the video timeline **102**, the program commences at a beginning associated with event **104**. The event **104**, which occurs at "frame **0**" at the beginning of the program, is associated with index point **174** and state **144**, which is a first state in the state table **114**. At the state **144**, a program attribute "btn.visible" **180** is set to "T" **182** for true, thereby making a button **184** appear on the program display **116**. A program attribute "image.file" **186** is set to "a" **188**, thereby making an associated image **190** appear on the program display. A program attribute "screen-.color" **192** is set to "6" **194**, changing a color of a background on the program display **116**.

The program continues to progress according to the video timeline **102** and reaches the event **106** which occurs at "frame i" at the beginning of a next segment of the program. The event **106** occurs at "frame i" and is associated with index point **176** and state **146**. Thus, upon reaching event **106**, index point **176** automatically triggers the state change to state **146**. At the state **146**, the program attribute "btn.visible" **180** is set to "F" **196** for false, thereby making the button **184** disappear from the program display **116**. The program attribute "image.file" **186** is set to "b" **198**, making an associated image (not shown) appear on the program display in the place of image **190**. The program attribute "screen.color" **192** is set to "8" **199**, again changing a color of a background on the program display. Similarly, as the events **108** at "frame j" and **110** at "frame k" are reached, index points **178** and **181**, respectively, trigger state changes in the state table **114** to the states **148** and **150**, respectively, thereby changing the appearance and behavior of the program as evidenced by the appearance of the display screen **116**. In sum, when events logged as index points are reached during execution of the program, states changes associated with the index points are triggered, thereby initiating associated attribute changes.

It will be appreciated that execution of an application as described by the non-limiting example advantageously can be performed upon actual execution of the application at a viewer/user location or in emulating the execution of the application prior to dissemination of the application. In the

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former case, the application might be executed by a STB which first loads the state change and index point information, then executes the state changes according to the index points. In the latter case, the application might be executed on a computer emulating the STB environment by loading the state change and index point information and allowing program developers or editors to monitor how the application will execute in a viewer/user environment. Facilities for executing the application in a viewer/user environment is further described in the concurrently filed and co-pending patent application entitled "METHOD AND SYSTEM FOR PROVIDING FLEXIBLE TIME-BASED CONTROL OF APPLICATION APPEARANCE AND BEHAVIOR," bearing Ser. No. 10/427,255, the contents of which are incorporated by reference. FIGS. **2A-2E** present screens from an environment in which such an application, controlled by tables **112** and **114** can be created, revised, and/or reviewed. FIG. **3** shows a routine for how such tables **112** and **114** can be generated in such an environment or other environments.

FIG. **2A** shows a screen shot from a development environment **200** for developing interactive programming in accordance with an embodiment of the present invention. A number of separate windows present different forms of information a program developer or author can use to create the control information for facilitating execution of the program. FIG. **2A**, as well as FIGS. **2B-2E**, shows a graphical user interface environment which facilitates point-and-click/drag-and-drop commands with which users of conventional personal computers and other microcomputers are well familiar. Taking advantage of a simplified environment provided, such as a graphical user interface-driven environment, embodiments of the present invention allow control information governing behavior of a computer system during computer system execution to be generated without writing computer program code. Accordingly, control information for controlling computer system execution can be created by designers as well as or instead of computer programmers. A graphical user interface-driven system represents one presently preferred embodiment of the present invention because it allows a program developer to simultaneously engage an underlying video and audio program with which the developer might be working and provides synergy in operation with an underlying visual medium. However, it will be appreciated that the controlling information also suitably are generated through text- and command-driven procedures, as also can be used in the embodiment shown in FIGS. **2A-2E**. Thus, embodiments of the present invention are not limited to a graphical user interface environment.

As previously mentioned, one presently preferred embodiment of the development environment **200** includes a number of windows. The development environment **200** suitably provides a familiar arrangement of icon and menus **202**. A program monitoring window **204** is operable both to display an underlying video program and display attributes being added or changed as will be further explained in connection with FIG. **2B**. Although not shown, it will be appreciated that a suitable audio device (not shown) also can be provided to allow for monitoring of associated audio content from the underlying program or that the developer suitably creates, revises, and/or associates with the underlying program. A layout window **205** lists objects currently being viewed by the user. A project window **206** allows the developer to view and manipulate the object hierarchy of the current project. An object window **208** gives the developer access to a library of objects or templates he or she can use in adding objects to the project hierarchy. Such objects and

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templates can be preprogrammed by a developer of the development environment, or might be objects or templates previously created by the program developer for his or her own later use, much as word processing and spreadsheet users can use preprogrammed macros or create their own macros to facilitate desired operations.

A resource window **210** gives the developer access to data files he or she has previously created, other multimedia elements he or she may want to include, or other resources he or she might want to import into the current project. An object property window **212**, as will be further described in connection with FIGS. **2**B and **2**D, manifests properties assigned to on-screen or other objects. As previously described, the developer can engage the graphical user interface system using graphical and kinesthetic interaction or can use a command- and text-driven approach. The object property window **212** manifests attribute features in a textual form for text- and command-driven review and manipulation. A state table window **214** allows the developer to control attribute changes. Attribute changes having common features can be grouped into states for linking their presentation together and/or to common event triggers as previously described in connection with the non-limiting example shown in FIG. **1** and in the concurrently filed co-pending applications incorporated by reference. Similarly, an index point window **216** allows the developer to associate attribute changes and state changes with events transpiring during execution of the program. The developer also can use the index point window **216** to assign various timing-based properties with the attributes as described in the concurrently filed co-pending applications incorporated herein by reference.

FIG. **2**B is a set of windows of the development environment shown in FIG. **2**A for developing attribute changes. In particular, the icon and menu structure **202**, the program monitoring window **204**, the layout window **205**, and the project window **206** are shown enlarged over their presentation in FIG. **2**A. In the program monitoring window **204**, facilities for creating and revising attributes or objects **220** are shown. Among the facilities shown are gridlines **222** for positioning objects. An application icon **224** is situated on the screen to signal to a viewer that the object on the screen marked by the application icon **224** is of interest to him or her. An application icon **224** can be used, for example, to signal a viewer interaction opportunity, such as the user having a chance to purchase the item marked with the application icon **224** through the use of his or her keyboard or remote control. Window specific icons-driven commands **226** are arranged to allow the user to manipulate the attributes. Such commands **226** might include one for enlarging a portion of displayed information, moving an overlapping attribute between a foreground and a background position, and other similar commands. The program monitoring window **204** also provides a view of the underlying program **228** for facilitating precision in placement, formatting, and consideration of attributes **220**.

Along with the program monitoring window, the developer can incorporate items from the project menu. As shown in FIG. **2**B, if an underlying program being viewed **228** in the program monitoring window, the developer may want to view or retrieve a recipe **227** from the project list to include in the present program. Also, using the layout window **205**, the user may want to select specific attributes such as an attribute representing a video of merchandise for sale **229** that the program developer is tasked with promoting.

Once the attributes are created in terms of their positions and formats, the developer can develop how the attributes will be presented, including as desired correlating the attributes with the underlying program. FIG. **2**C is a set of windows of the development environment developing index points for controlling attribute changes including the index point window **216**. The operation of index points is described in detail in the concurrently filed co-pending application "METHOD AND SYSTEM FOR FLEXIBLE TIME-BASED CONTROL OF APPEARANCE AND BEHAVIOR OF SOFTWARE APPLICATION," bearing Ser. No. 10/427,343.

As can be seen in FIG. **2**C, the index points window **216** is visually presented in timeline form allowing for graphical manipulation of points at which attributes will be introduced and/or changed. An index tables window **230** represents sets of attributes, such as "RecipeSegments" **232** and "InfoSegments" **234** which may be presented as part of the program. Within these sets of attributes, individual attributes can be set to modify the appearance of these attributes at specific times. For example, in the RecipeSegments set **232**, index points relating to attributes concerning ingredients **236**, such as asparagus and eggs, can be set. Similarly, in the InfoSegments set **234**, index points relating to other content **238** such as "Oven" and "TableStools" can be set. As will be appreciated, different sets of attributes **232** and **234** might use different types of index points having characteristics which control whether attributes are presented depending on whether computer system execution commenced before events associated with the index point are reached (as explained in the patent application bearing Ser. No. 10/427,343 previously incorporated by reference). In any case, as can be seen in FIG. **2**C, attributes **236** related to the RecipeSegments **232** have a single-ended index point **237** while the attributes **238** related to the InfoSegments have a range-specified index point **239**. It will be appreciated that embodiments of the present invention both allow flexibility to choose different index points **237** and **239**, and to allow a user to engage them through a graphical user interface.

In addition, the index points window **216** provides other features for supporting a program designer in associating attributes changes with events taking place during program execution through the use of index points. Event monitoring windows **240** and **241** allow the developer to monitor at what specific point in the program he or she is working in associating events with index points. The developer can use a first monitoring window **240** to monitor a frame number or a second monitoring window **241** to monitor program elapsed time, or the program developer can reference both windows **240** and **241**. Tools also are provided to allow the developer to control a flow of the program to monitor the underlying program and set index points. For example, a play/pause control **242** allows the developer to control sequencing of the program in a way familiar to users of VCRs and DVD players. Segment controls **244** allow the developer to move back and forth between identified segments, as well as to associate index points with chosen events along the timelines represented in the index points window **216**. In sum, the index points window **216** and its associated displays and tools allow the program developer to identify events for triggering attribute changes and associating them with index points.

FIG. **2**D is a set of windows of the development environment shown in FIG. **2**A for developing an attribute change table interacting with the set of index points. As the attributes **220** (FIG. **2**B) were created and index points were associated with events taking place during the program (FIG. **2**C), the state table window **214** allows the developer to collect attribute changes **254** into states which can be

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associated with the index points generated through the index points window **216** (FIG. **2C**). The object property window **212** lists properties about attributes to be presented to the user. Sets of properties **250** relating to the attributes are collected into state changes represented in a column associated as a state change. Attribute changes can be made collectively over the course of successive state changes **251**. For example, the attribute change for "txtlnfoLabel" **254** is assigned different values for different state changes **251**. Multiple attribute changes keyed by common events **258** are collected in state changes **251** represented as columns such that reaching an event associated by an index point with the state changes results in automatic initiation of the attribute changes so grouped. The state changes **251** can be associated with index points in the index points window **216** to control timing of the attribute changes keyed by common events **258** collected in a state table. Again, the operation of state changes grouped into such tables and their triggering using index points is described in more detail in the example described in connection with FIG. **1**, as well as in the concurrently filed copending applications bearing Ser. Nos. 10/427,735 and 10/427,343 previously incorporated by reference.

FIG. **2E** shows a monitoring environment **270** in which the result of attribute changes generated and keyed to index points can be reviewed. The monitoring environment includes a viewing window **272** for showing the program including attribute changes **274** generated. An application icon **224** is situated on the screen to signal to a viewer that the object on the screen marked by the application icon **224** is of interest to him or her. An application window allows **278** allows for text- and command-drive manipulation of code associated with the attribute changes, if the developer desires to make changes beyond or in addition to those that can be made through manipulation of the tables. A status window **280** textually presents a list of functions being executed to present the attribute changes shown so that the developer can monitor what is causing the attributes shown on the screen.

For testing interactive programs, a recording window **282** and a remote window **284** are provided. The developer can simulate how a viewer or user of an interactive program might interact with a STB or other device to engage the program. For example, if a program such as a cooking show offers opportunities to purchase merchandise, the developer can click on a screen button **285** to simulate a user making a choice on a keypad. As a result, this allows the developer to determine how well interactive attribute changes he or she created will function. Similarly, the recording window **282** records actions of the simulated user to allow the interactive program to be played back to review how well the interactive functionality operated. A resource monitoring window **286** also allows the developer to monitor system resource usage, such as memory usage, to determine whether the program meets practical constraints and objectives.

FIG. **3** is a flowchart showing a routine **300** for developing attribute changes according to an embodiment of the present invention. At a block **302**, the routine begins and continues at a block **304** with reviewing any underlying video and/or audio program. At a block **306**, attribute changes to be made or modified are identified. At a block **308**, the attribute changes are generated or modified as desired. At a block **310**, the attribute changes are assigned positions, colors, sizes, font types, and other attributes configurable in the development environment (FIGS. **2A-2E**). At a block **312**, attribute changes having common triggering events are grouped together, as commonly initi-

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ated attribute changes were grouped into state changes as described in connection with FIG. **2C**. From these collected attribute changes, at a block **314** an attribute change table is generated for controlling some or all of the attributes connected with the program.

At a block **316**, time dependency of collected attribute changes are selected as described in connection with FIGS. **2C** and **2D**. The user determines when the collected attribute changes are to begin, when their properties are to change, when their properties are to end, and, possibly, whether the attribute changes should be initiated if the event associated with the attribute changes was reached before computer system execution commenced. Further details concerning these time-dependencies are described in the concurrently filed co-pending patent application bearing Ser. No. 10/427, 343 incorporated by reference. At a block **318**, starting points or stopping points for attribute changes are set. At a block **320**, conditional properties of the attribute changes are set. These conditional properties include whether the associated attribute changes are displayed if an event associated with the index point triggering the attribute change has passed before program execution has commenced, as further described in the concurrently filed co-pending application "METHOD AND SYSTEM FOR FLEXIBLE TIME-BASED CONTROL OF APPEARANCE AND BEHAVIOR OF SOFTWARE APPLICATION," bearing Ser. No. 10/427, 343. At a block **322**, an index table collecting the index point information is generated to work with the attribute change table generated at the block **314**. In one presently preferred embodiment, these tables suitably are stored, revised, and transmitted separately to allow flexibility in modifying applications while reducing computer and/or transmission bandwidth overhead.

At a decision block **324**, it is determined if review of the attribute changes is desired. If so, attribute changes are reviewed and tested at a block **326** as previously described in connection with FIG. **2E**. If it is determined at a decision block **328** that changes are desired, the routine loops to the block **304** to begin reviewing content of the program and changing the attributes as desired. However, if it is determined at the decision block **324** that no further review is needed or it is determined at the decision block **328** that no changes are needed, the routine ends at a block **330**.

FIG. **4** is a block diagram of a data processing/media control system for generating applications and attribute changes according to an embodiment of the present invention. Specifically, FIG. **4** shows a computer system **400** operable for using embodiments of the present invention. The computer system **400** is operable for controlling a display **402**, such as a computer monitor or television, and an audio subsystem **404**, such as a stereo or a loudspeaker system. The computer system **400** receives input from a network or storage **406**. The network suitably is a computer network coupled with broadcast facilities for the transmission of programs created and modified using the system **400**. The computer system **400** also receives user input from a wired or wireless user keypad **408**, which may be in the nature of a computer keyboard or another input device.

The computer system **400** receives input via an input/output controller **410**, which directs signals to and from a video controller **412**, an audio controller **414**, and a central processing unit (CPU) **416**. In turn, the CPU **416** communicates through a system controller **418** with input and storage devices such as read only memory (ROM) **420**, system memory **422**, system storage **424**, and input device controller **426**.

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The computer system **400** shown in FIG. **4** thus can revise and process attribute changes collected in attribute change tables and index tables and pass them through the input/output controller **410** to the CPU **416** where they will be processed through the system controller **418**, suitably in response to user input gathered through the user keypad **408** and the input device controller **426**. The state changes collected in the table can then be executed and/or modified as triggered by the index points in the index table as previously described in connection with the foregoing example, method flowcharts, block diagrams, and co-pending patent applications incorporated by reference. User input or emulated user input can be returned by the input device controller **426** through the system controller **418** to the CPU **416** for processing. In turn, the CPU **416** transmits the information through the input/output controller **410** to the network for broadcast or other tranmission or to storage **406** as appropriate. Advantageously, changes can be made using this system **400** for immediate broadcast via the network **406**.

While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

What is claimed is:

1. A method for providing an authoring environment for generating an attribute change correlating with an underlying program to be executed by a computer system, the method comprising:

    providing a program monitor configured to monitor an underlying program;

    providing a timeline configured to represent execution of the underlying program;

    providing an attribute editor configured to allow one of creation, modification, and deletion of an attribute change;

    providing an index editor configured to allow one of creation, association, modification, and deletion of an index point correlating the attribute change with an event taking place during execution of the underlying program;

    providing an attribute monitor configured to observe execution by the computer system of the underlying program and the attribute change correlated with the underlying program; and

    providing an attribute generator configured to store the attribute change and the index point such that a computer system configured to execute the underlying program and the attribute change initiate the attribute change upon the index point being reached during execution of the computer system.

2. The method of claim **1**, wherein the authoring environment is configured with a graphical user interface.

3. The method of claim **1**, wherein the attribute editor is further configured to display at least one of a position attribute, a content attribute, and an appearance element of the attribute change.

4. The method of claim **1**, wherein the attribute editor is further configured to display the index point with which the attribute has been associated.

5. The method of claim **4**, wherein the attribute editor is further configured to display a state table colleting a plurality of attribute changes.

6. The method of claim **5**, wherein the attribute editor is configured to group a plurality of attribute changes triggered by a common index point into a common state change.

7. The method of claim **5**, wherein the state table lists the attribute changes along a first dimension of the state table and state changes along a second dimension of the state table such that as each current state change is reached, each attribute change associated with the current state change is triggered.

8. The method of claim **1**, wherein the index editor is further configured to display at least one of an index property and the event with which the index point is associated.

9. The method of claim **8**, wherein the index property includes a timing characteristic indicating whether the attribute change associated with the index point will be initiated if the execution of the computer system commenced after event associated with the index point has been reached.

10. The method of claim **4**, wherein the attribute editor is further configured to display an index table collecting a plurality of index points.

11. The method of claim **10**, wherein the index table includes a first column listing the index point and a second column listing the associated attribute change.

12. The method of claim **1**, including transmitting data including at least one of the index point and the attribute change to remote locations such that a remote computer system can initiate the attribute change contemporaneously with receiving the data.

13. A computer readable medium for providing an authoring environment for generating an attribute change correlating with an underlying program to be executed by a computer system, the computer readable medium comprising:

    first computer program code means for providing a program monitor configured to monitor an underlying program;

    second computer program code means for providing a timeline configured to represent execution of the underlying program;

    third computer program code means for providing an attribute editor configured to allow one of creation, modification, and deletion of an attribute change;

    fourth computer program code means for providing an index editor configured to allow one of creation, association, modification, and deletion of an index point correlating the attribute change with an event taking place during execution of the underlying program;

    fifth computer program code means for providing an attribute monitor configured to observe execution by the computer system of the underlying program and the attribute change correlated with the underlying program; and

    sixth computer program code means for providing an attribute generator configured to store the attribute change and the index point such that a computer system configured to execute the underlying program and the attribute change initiate the attribute change upon the index point being reached during execution of the computer system.

14. The computer readable medium of claim **13**, including seventh computer program code means for providing the authoring environment is configured with a graphical user interface.

15. The computer readable medium of claim **13**, wherein the third computer program code means is further configured

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to display at least one of a position attribute, a content attribute, and an appearance element of the attribute change.

16. The computer readable medium of claim 13, wherein the third computer program codes means is further configured to display the index point with which the attribute has been associated.

17. The computer readable medium of claim 16, wherein the third computer program code means is further configured to display a state table colleting a plurality of attribute changes.

18. The computer readable medium of claim 17, wherein the third computer program code means is configured to group a plurality of attribute changes triggered by a common index point into a common state change.

19. The computer readable medium of claim 17, wherein the state table lists the attribute changes along a first dimension of the state table and state changes along a second dimension of the state table such that as each current state change is reached, each attribute change associated with the current state change is triggered.

20. The computer readable medium of claim 13 wherein the fourth computer program code means is further configured to display at least one of an index property and the event with which the index point is associated.

21. The computer readable medium of claim 20, wherein the index property includes a timing characteristic indicating whether the attribute change associated with the index point will be initiated if the execution of the computer system commenced after event associated with the index point has been reached.

22. The computer readable medium of claim 16, wherein the fourth computer program code means is further configured to display an index table collecting a plurality of index points.

23. The computer readable medium of claim 22, wherein the index table includes a first column listing the index point and a second column listing the associated attribute change.

24. The computer readable medium of claim 13, including fifth computer program code means for transmitting data including at least one of the index point and the attribute change to remote locations such that a remote computer system can initiate the attribute change contemporaneously with receiving the data.

25. A system for providing an authoring environment for generating an attribute change correlating with an underlying program to be executed by a computer system, the system comprising:

a user interface comprising:
    a first component configured to provide a program monitor configured to monitor an underlying program;
    a second component configured to provide a timeline configured to represent execution of the underlying program;
    a third component configured to provide an attribute editor configured to allow one of creation, modification, and deletion of an attribute change;
    a fourth component configured to provide an index editor configured to allow one of creation, associa-

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tion, modification, and deletion of an index point correlating the attribute change with an event taking place during execution of the underlying program;
    a fifth component configured to provide an attribute monitor configured to observe execution by the computer system of the underlying program and the attribute change correlated with the underlying program; and

a processor configured to provide an attribute generator configured to store the attribute change and the index point such that a computer system configured to execute the underlying program and the attribute change initiate the attribute change upon the index point being reached during execution of the computer system.

26. The system of claim 25, wherein the authoring environment is configured with a graphical user interface.

27. The system of claim 25, wherein the attribute editor is further configured to display at least one of a position attribute, a content attribute, and an appearance element of the attribute change.

28. The system of claim 25, wherein the attribute editor is further configured to display the index point with which the attribute has been associated.

29. The system of claim 25, wherein the attribute editor is further configured to display a state table colleting a plurality of attribute changes.

30. The system of claim 29, wherein the attribute editor is configured to group a plurality of attribute changes triggered by a common index point into a common state change.

31. The system of claim 25, wherein the state table lists the attribute changes along a first dimension of the state table and state changes along a second dimension of the state table such that as each current state change is reached, each attribute change associated with the current state change is triggered.

32. The system of claim 25, wherein the index editor is further configured to display at least one of an index property and the event with which the index point is associated.

33. The system of claim 32, wherein the index property includes a timing characteristic indicating whether the attribute change associated with the index point will be initiated if the execution of the computer system commenced after event associated with the index point has been reached.

34. The system of claim 25, wherein the attribute editor is further configured to display an index table collecting a plurality of index points.

35. The system of claim 34, wherein the index table includes a first column listing the index point and a second column listing the associated attribute change.

36. The system of claim 25, including a sixth component configured to transmit data including at least one of the index point and the attribute change to remote locations such that a remote computer system can initiate the attribute change contemporaneously with receiving the data.

*   *   *   *   *

Exhibit D

US007430718B2

(12) **United States Patent**
Gariepy-Viles

(10) **Patent No.:** **US 7,430,718 B2**
(45) **Date of Patent:** **Sep. 30, 2008**

(54) **CONFIGURABLE INTERFACE FOR TEMPLATE COMPLETION**

(75) Inventor: **Aimee Gariepy-Viles**, Hood River, OR (US)

(73) Assignee: **Ensequence, Inc.**, Portland, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 453 days.

(21) Appl. No.: **11/160,400**

(22) Filed: **Jun. 22, 2005**

(65) **Prior Publication Data**

US 2006/0053390 A1   Mar. 9, 2006

Related U.S. Application Data

(60) Provisional application No. 60/608,206, filed on Sep. 9, 2004.

(51) **Int. Cl.**
G06F 15/00 (2006.01)
G06F 13/00 (2006.01)

(52) **U.S. Cl.** **715/700**; 725/25

(58) **Field of Classification Search** 715/700, 715/762, 764, 716, 761–763; 725/42, 25
See application file for complete search history.

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Primary Examiner—Cao "Kevin" Nguyen
(74) *Attorney, Agent, or Firm*—Black Lowe & Graham, PLLC

(57) **ABSTRACT**

Systems, methods and graphical user interfaces for creating interactive television applications are provided. A template author creates a template application and assigns placeholder objects do display elements. An episodic creator creates an episodic application by making changes to display elements associated with a presented placeholder object.

5 Claims, 8 Drawing Sheets
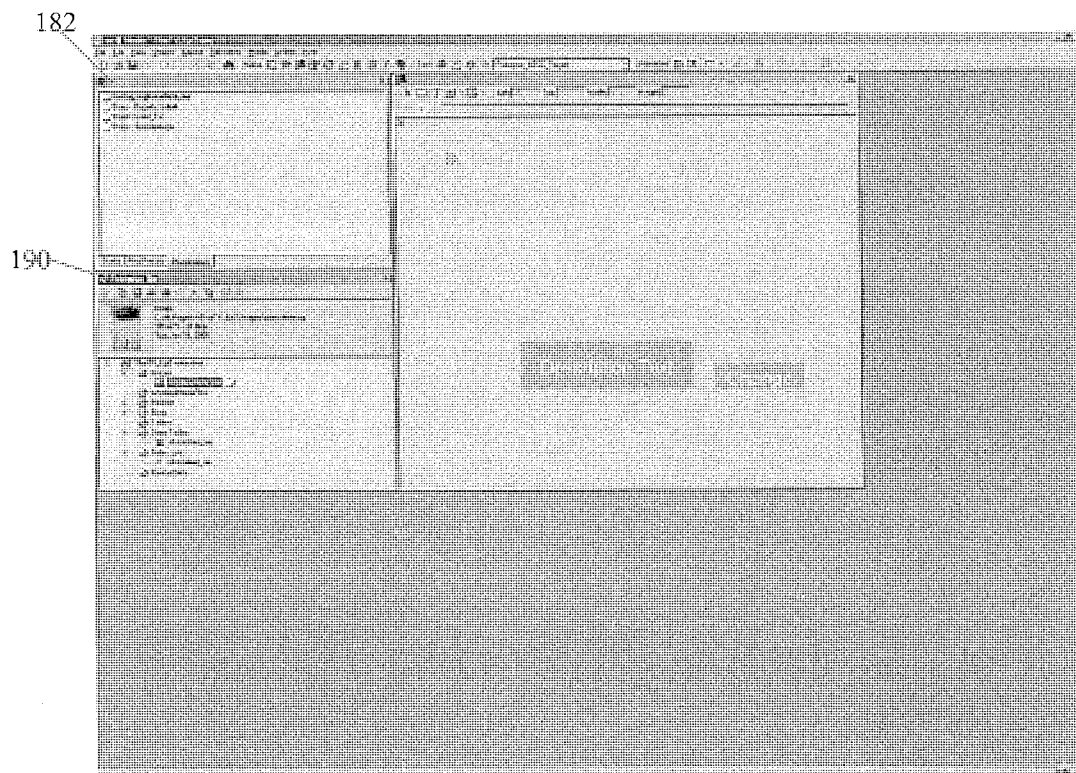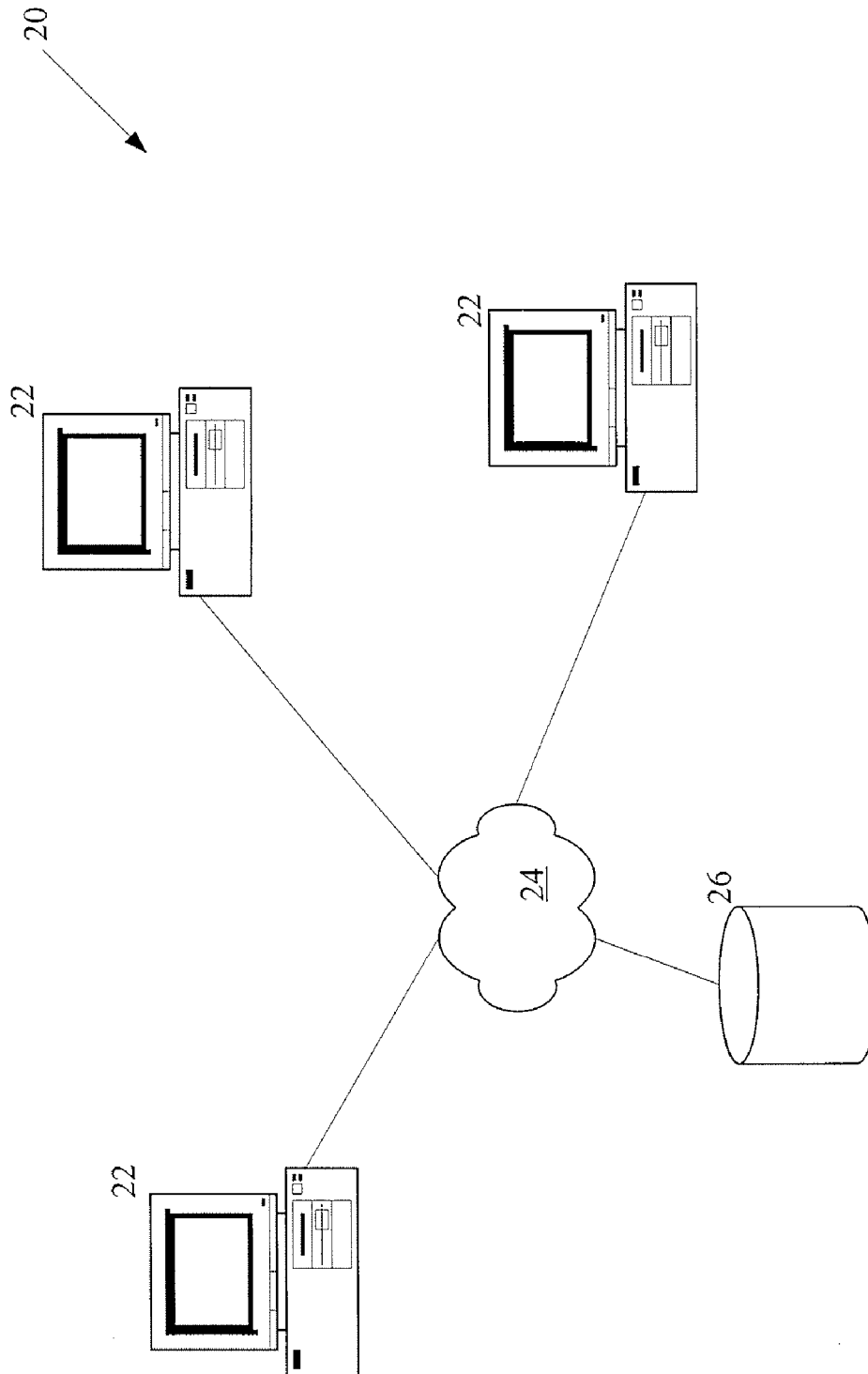
FIG. 1.

FIG. 2A.

FIG. 2B.

FIG. 2C.

FIG. 2D.

FIG. 2E.

FIG. 2F.

FIG. 2G.

FIG. 3A.

FIG. 3B.

FIG. 3C.

FIG. 3D.

182

FIG. 3E.

182

200
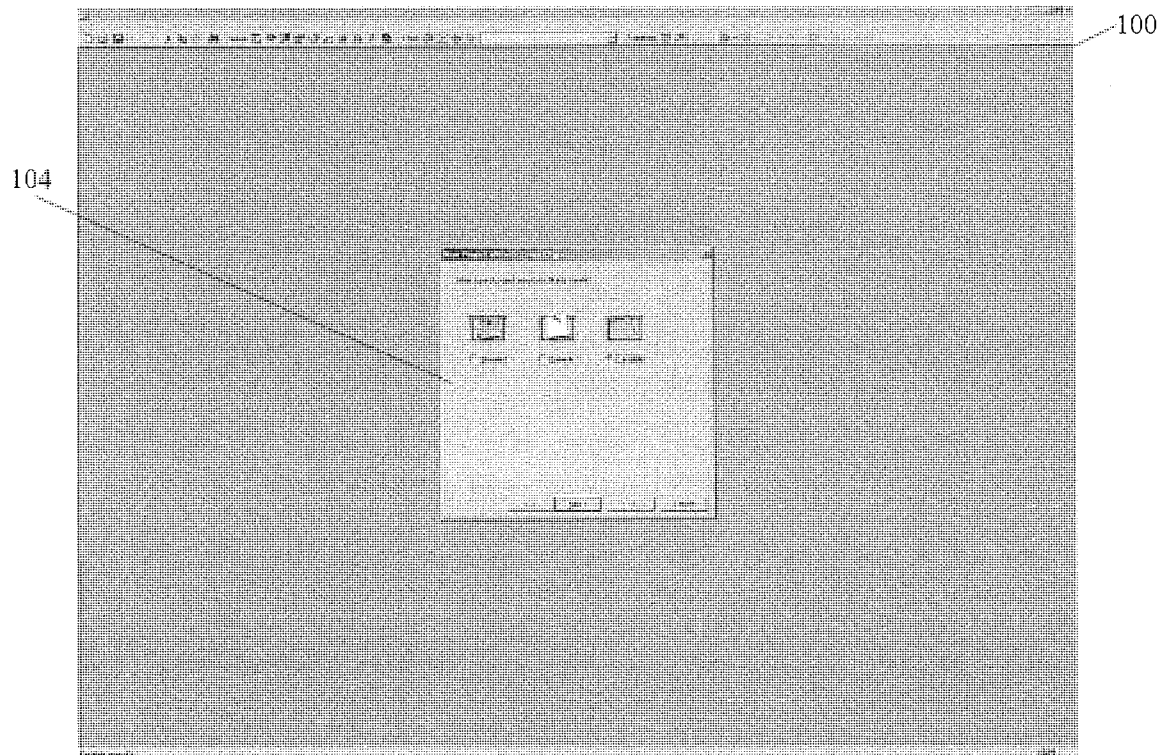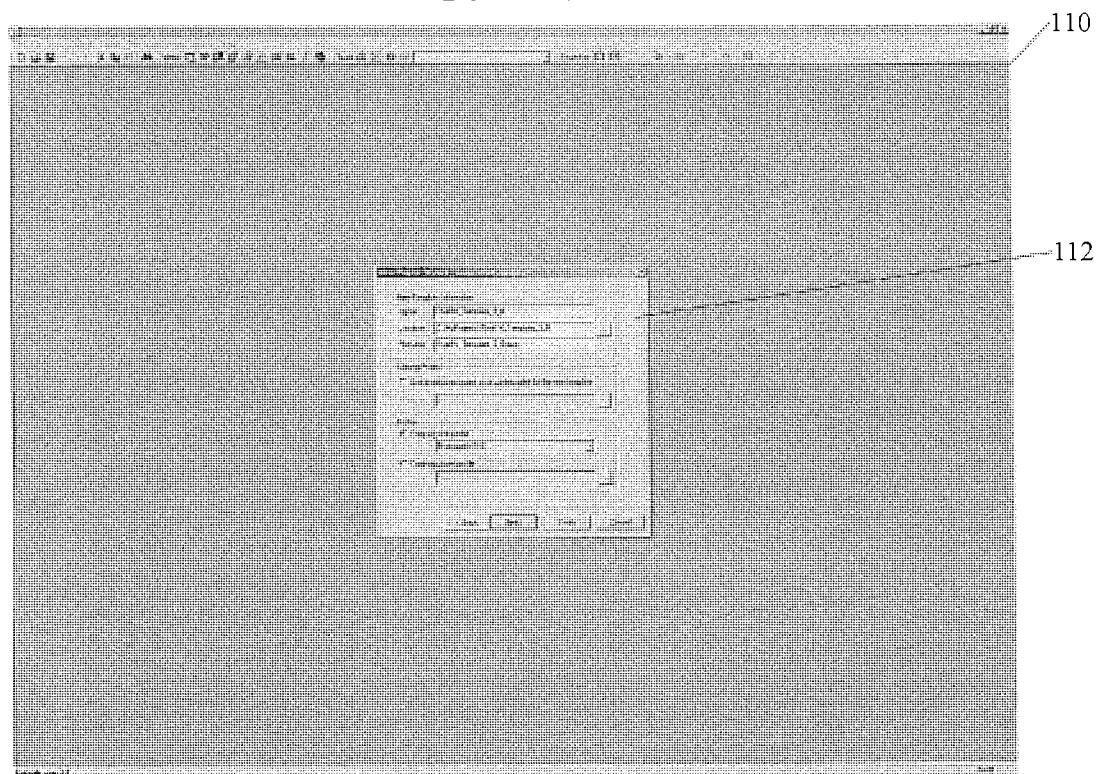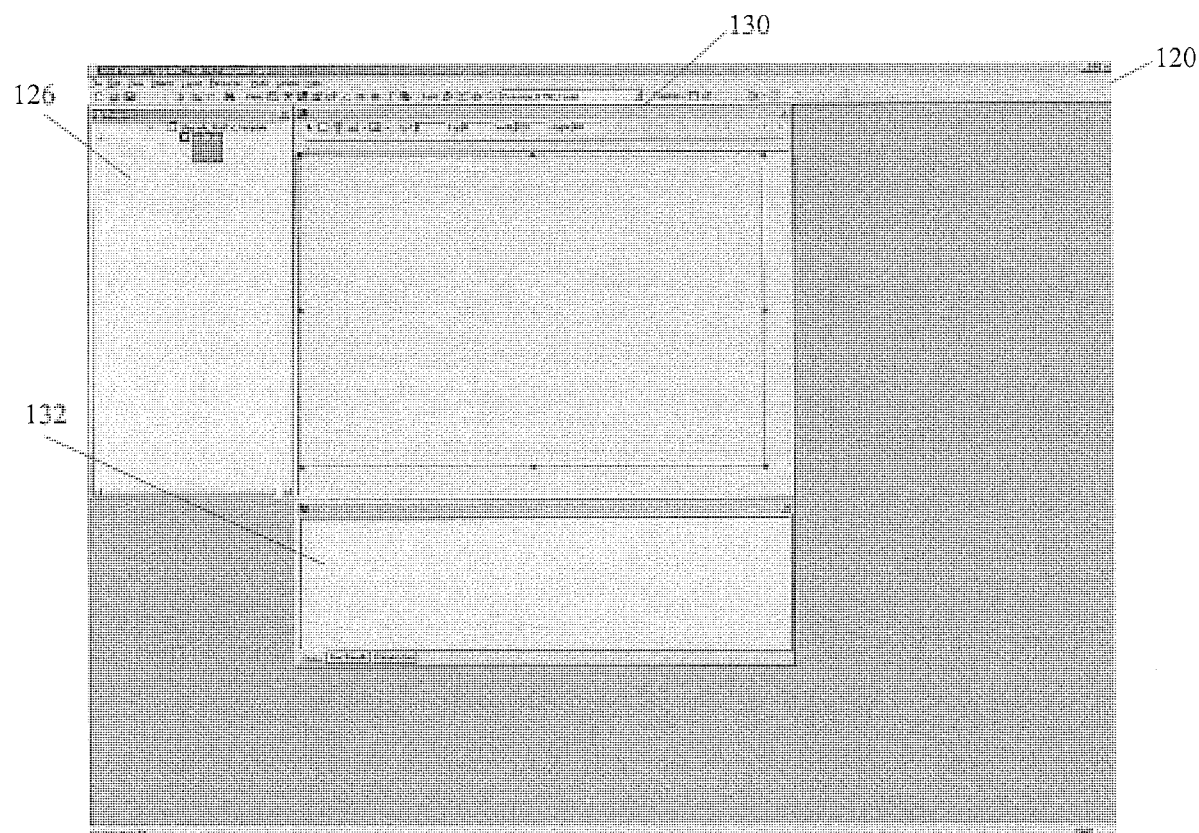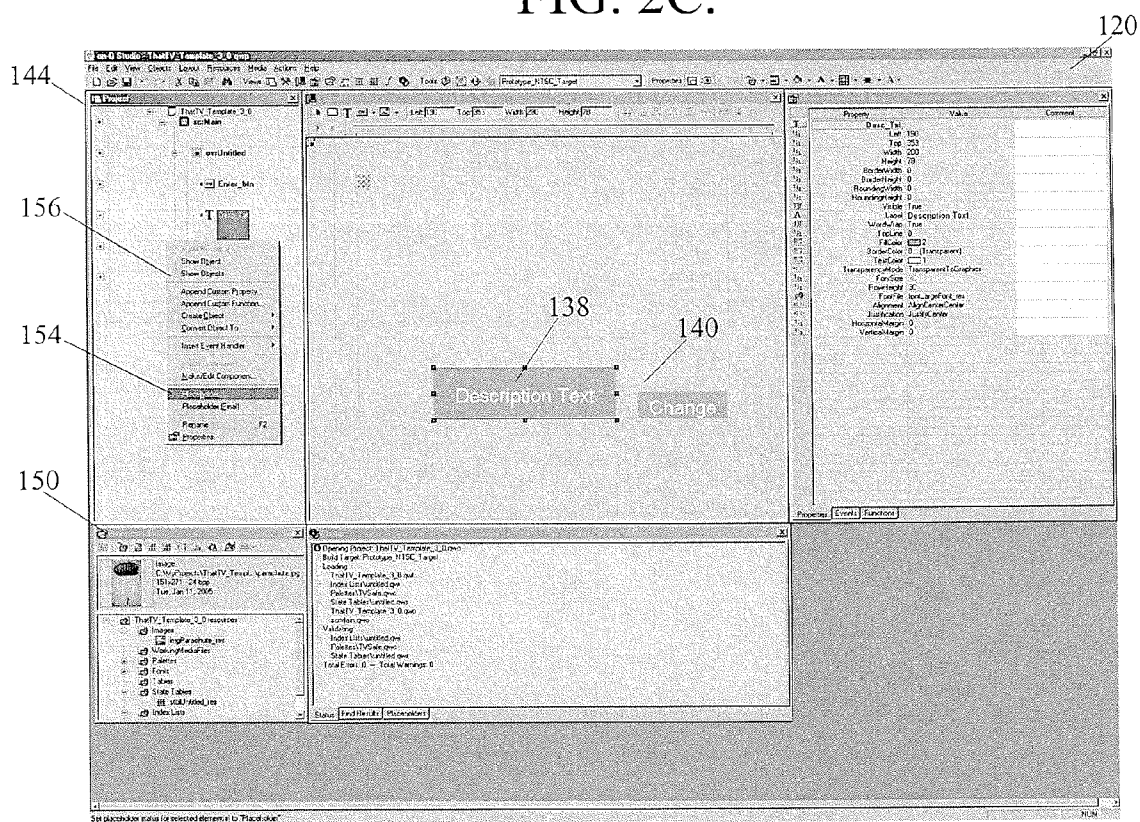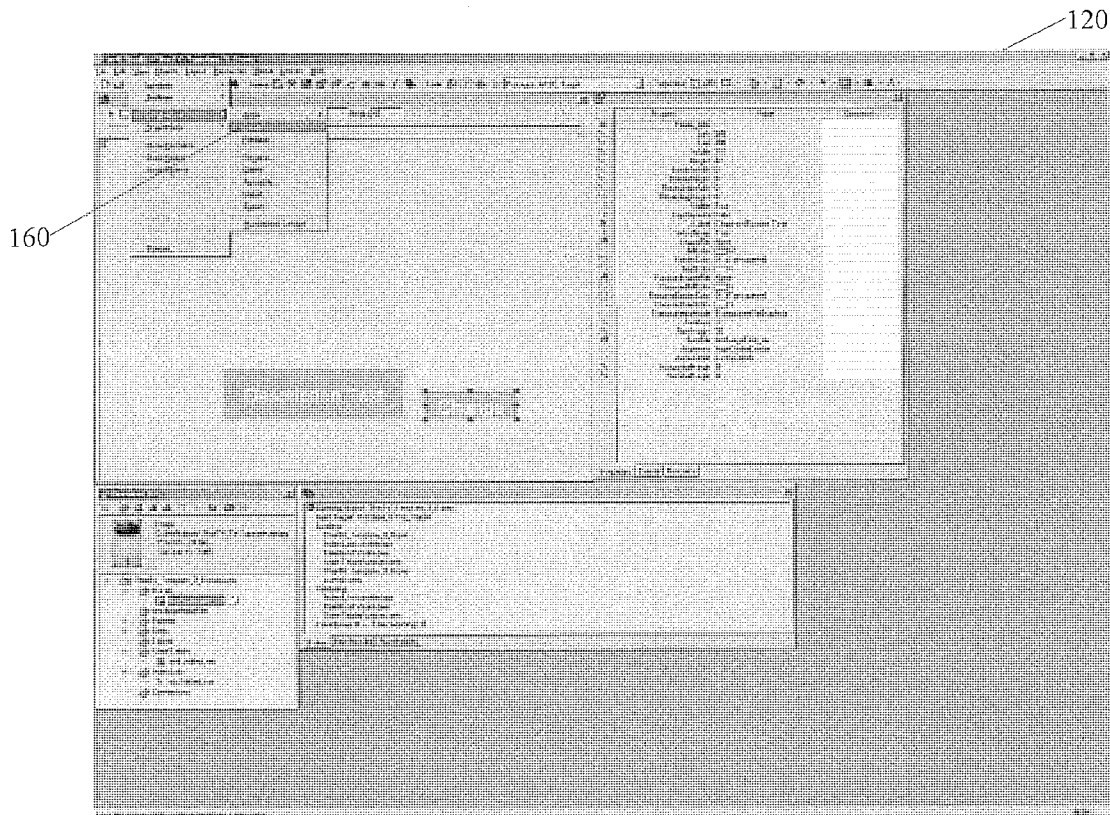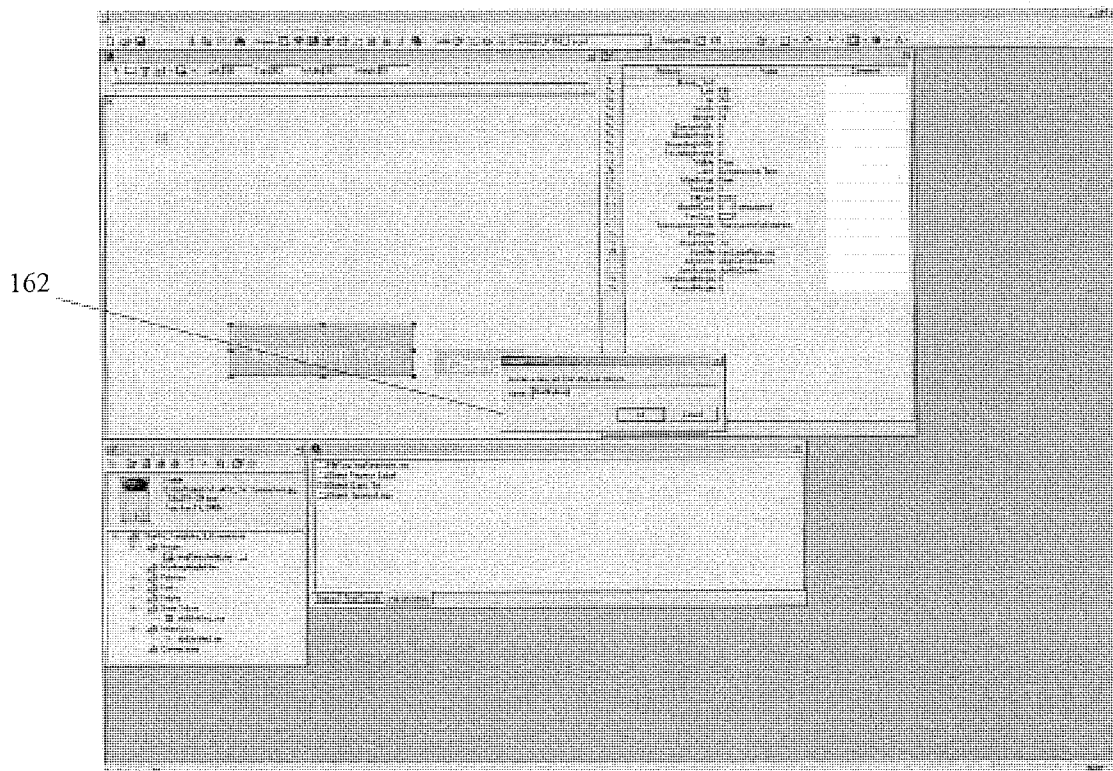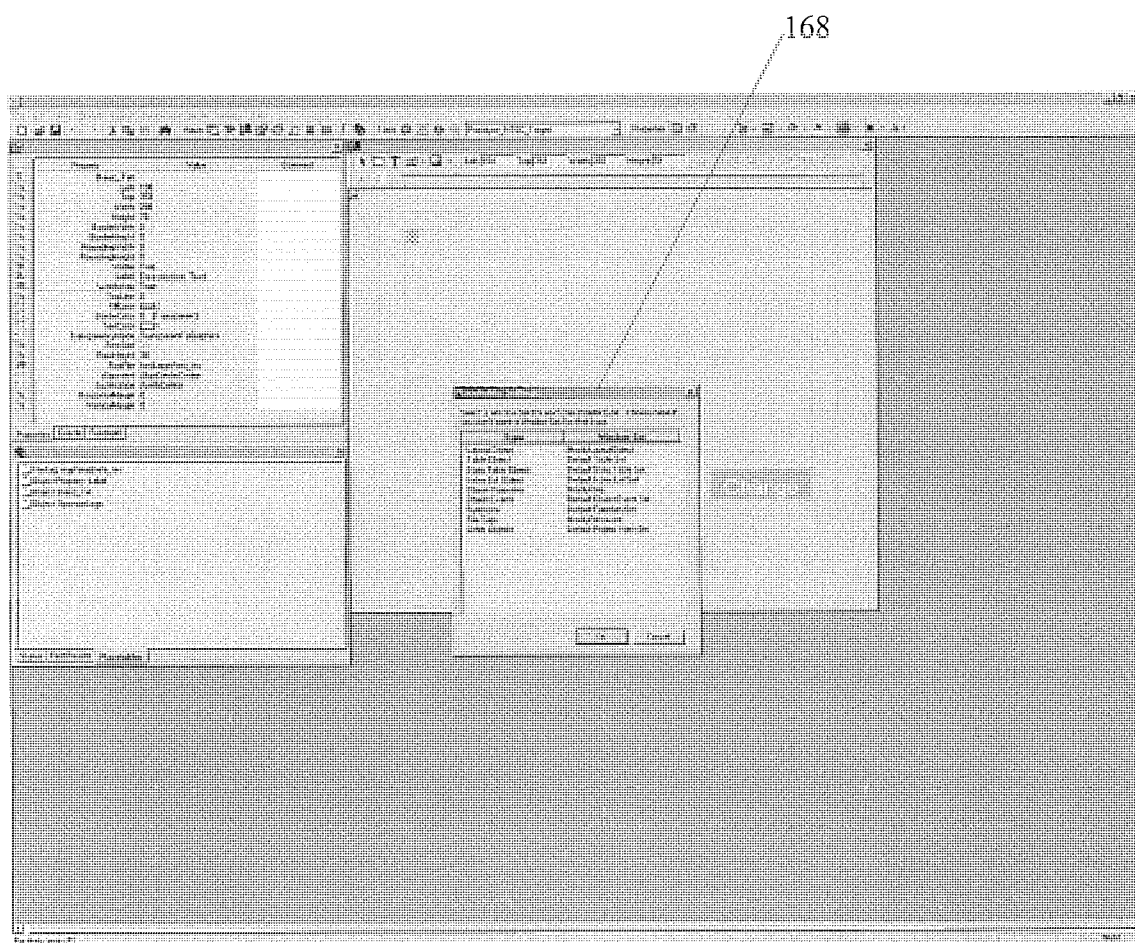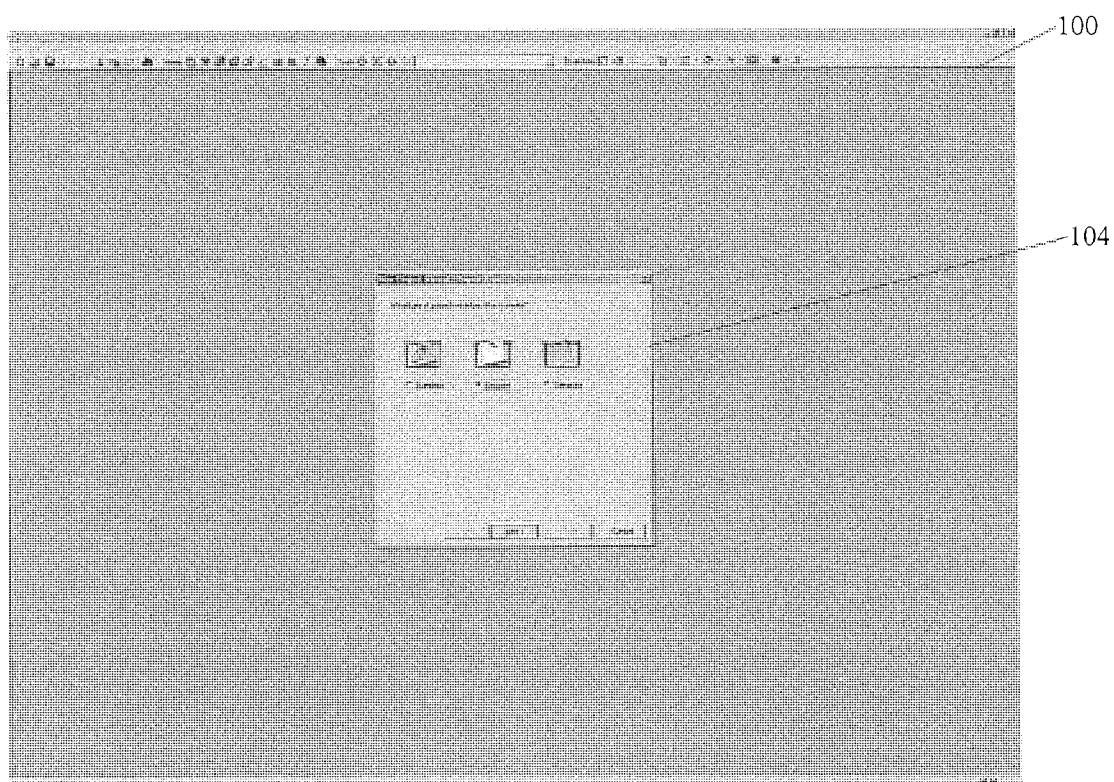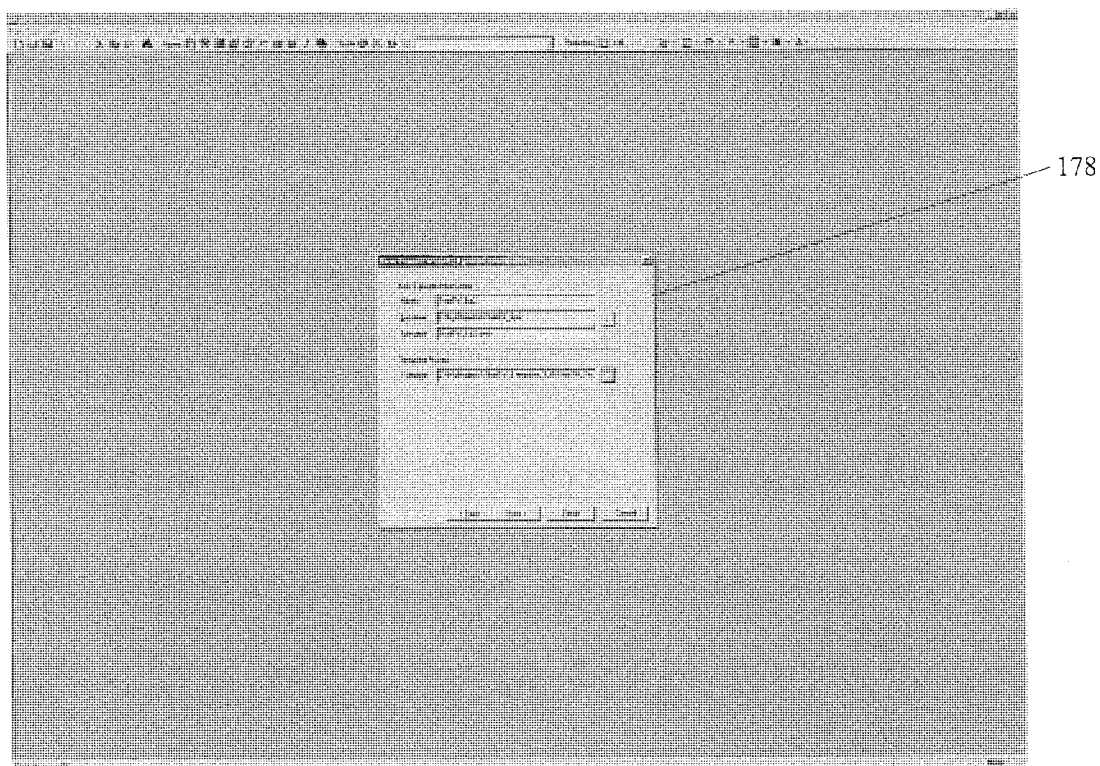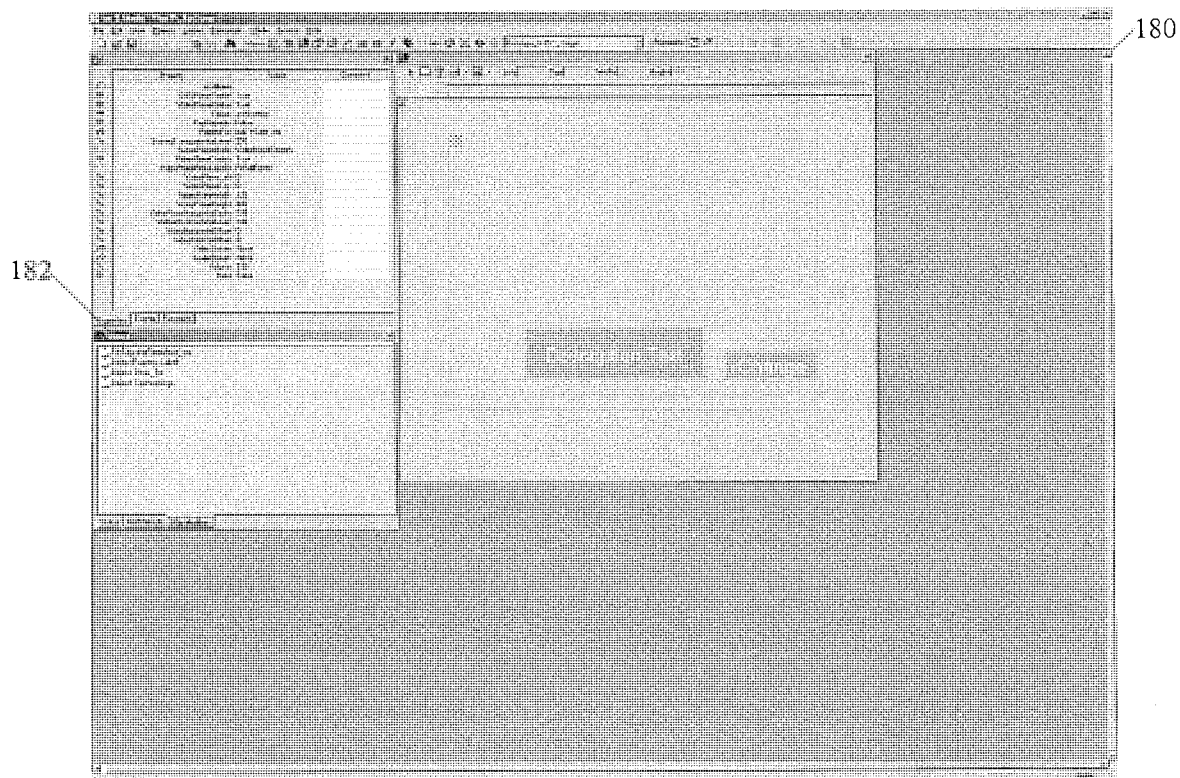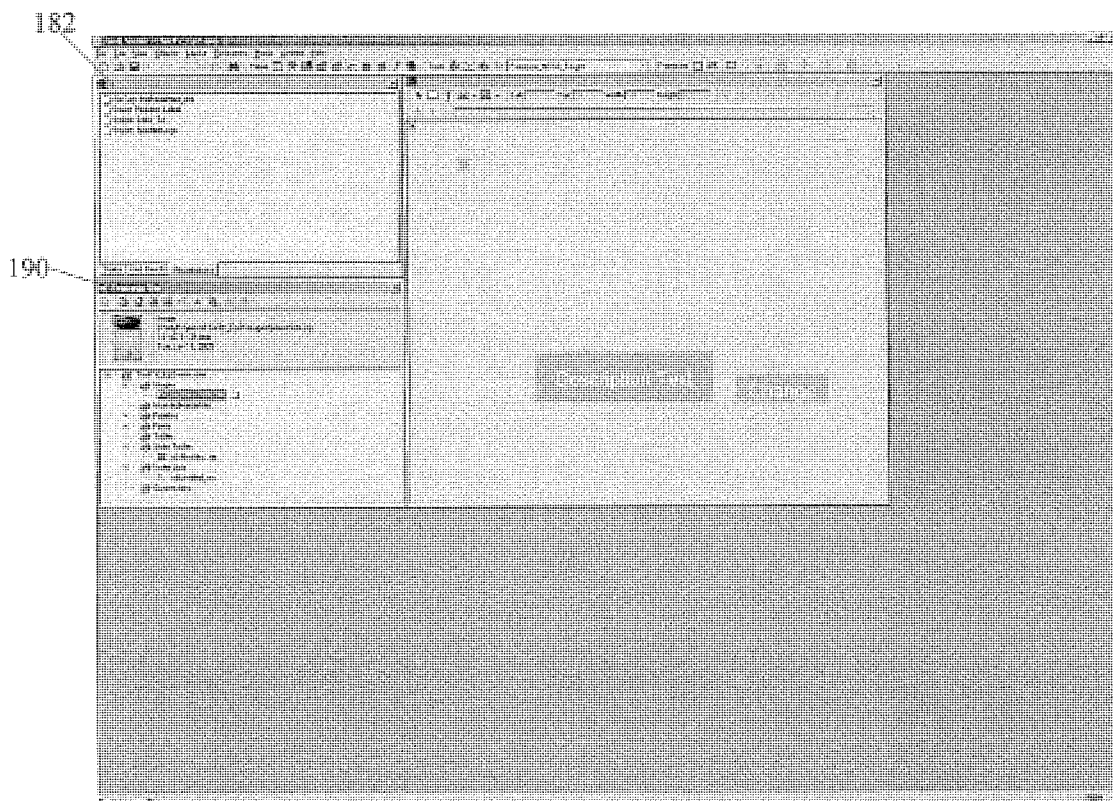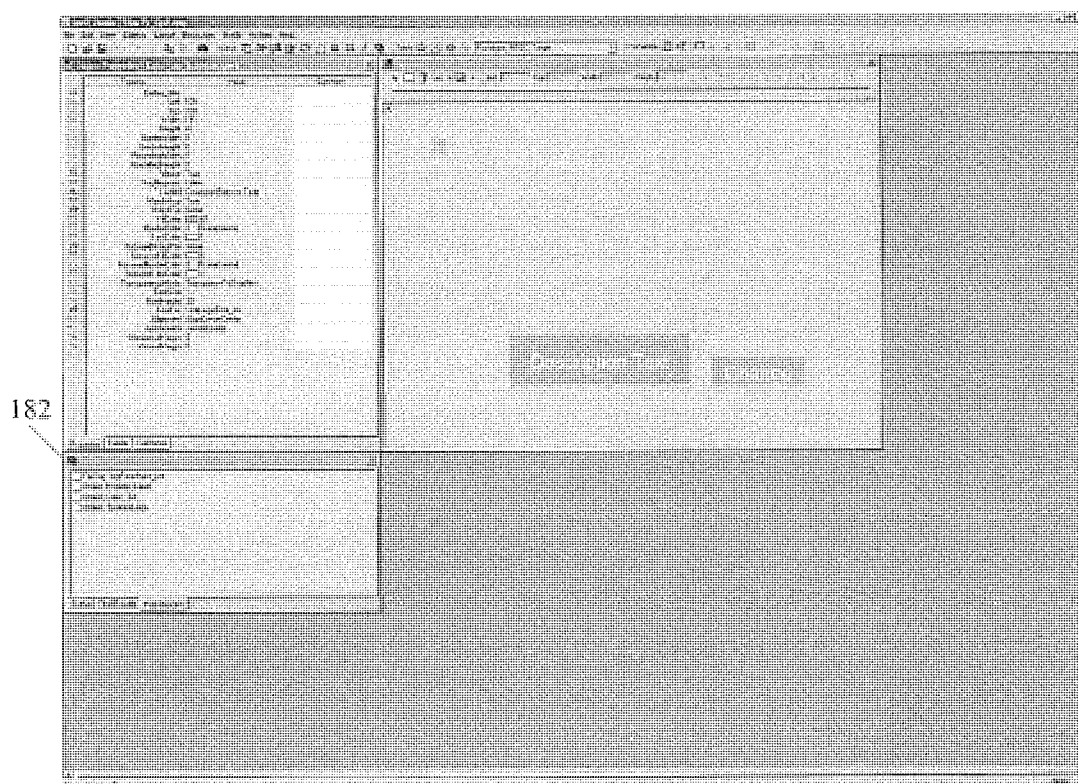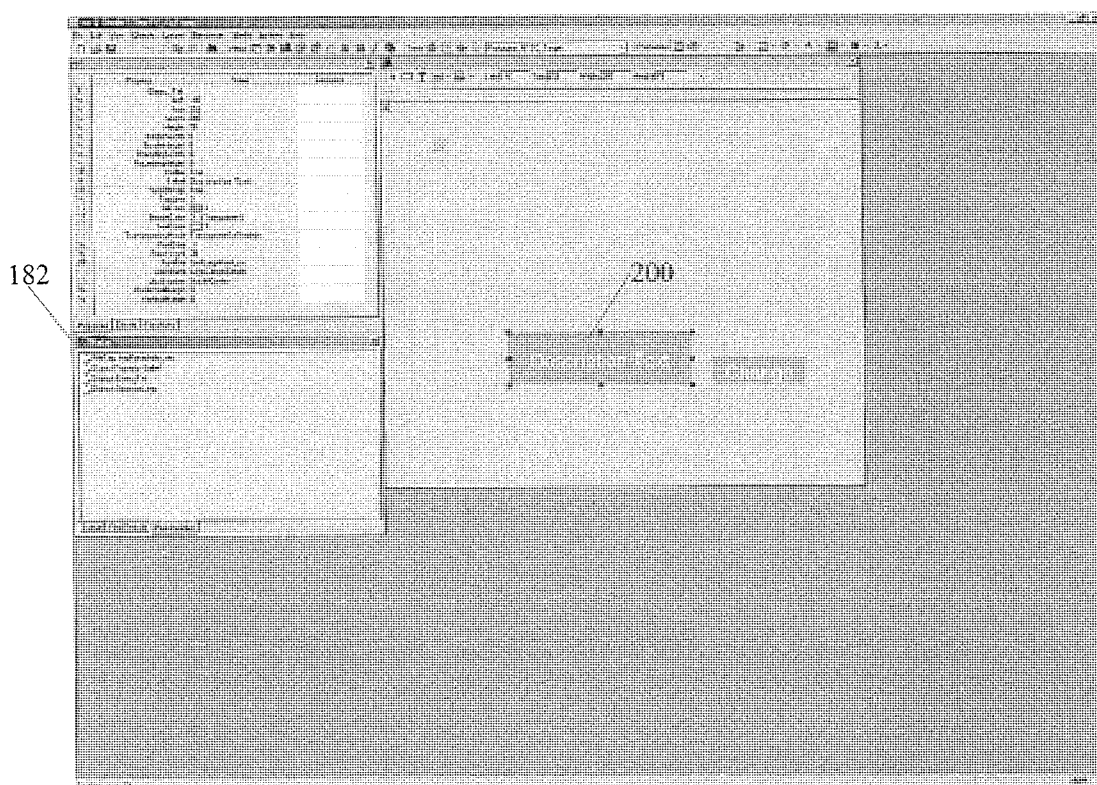
FIG. 3F.

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CONFIGURABLE INTERFACE FOR TEMPLATE COMPLETION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Ser. No. 60/608,206 filed Sep. 9, 2004, the contents of which are hereby incorporated by reference.

FIELD OF THE INVENTION

This invention relates generally to user interface systems and, more specifically, to templates for graphical user interfaces.

BACKGROUND OF THE INVENTION

Early user interface systems presented a monolithic appearance to the user. There was no opportunity for the user to customize the appearance or functionality of the interface to match the user's preferences or needs. As windowing interfaces were developed, an early feature of such interfaces was the ability to move a particular graphical display window about the screen, with the position of the window being remembered from one session to another. As processors became more powerful, operating systems began to provide enhanced opportunities for users to select among various options, such as the font for text display and background colors or images.

Today, most high-end software tools and operating systems allow for substantial amounts of customization by the user, including such features as adding or deleting icons from toolbars, selecting the font face, style and size for text display, selecting graphical color and sharing schemes, and window/sub-window/pane size, position, and stacking order.

A complex example of such interface customization is provided by U.S. Pat. No. 6,232,968 to Alimpich, et al. '968 describes a system for controlling computer operation (specifically the management of printer systems), whereby the user selects among a variety of different sets of interactive functions for the control of multiple types of application program operations. Once the user makes choices from the available options, the user can switch between two or more different interface options for controlling each of two or more different program operations.

Interactive television (iTV) is a growing area of software development. Traditionally, creating an iTV application was a lengthy and expensive process, requiring intimate knowledge of the details of system software and hardware on the set-top boxes (STBs) on which an application would execute. For this reason, iTV applications were often designed for reuse. A template application might have replaceable resources, such as images or text content, and adjustable timing for behavior that is intended to be synchronized with particular program content. An example of such a template application is a play-along game show application, in which the questions and answers vary from week-to-week, as does the timing of presentation of the questions to the game show participants (and thus to the viewer).

A challenge in creating and using such template applications is the need to create an easy-to-use environment for refilling or redefining various placeholder aspects of the template, such as image, text and data. In some cases, the high cost of developing the application has justified the creation of a specialized data entry application specifically for filling in the content of the template for reuse. When a user loads an

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episodic project, it is not very obvious what item(s) need to be changed or how to change them.

As with many design and development tools, the general authoring interface is overly complex and daunting for the simpler tasks involved in filling in placeholder content when working with an application template. Therefore, there exists a need for a mechanism that provides guidance and assistance to a technician who is working with an application template in the authoring suite.

BRIEF SUMMARY OF THE INVENTION

The present invention allows a designer to specify how the environment will appear and function for an end user of the development tool. The present invention is applicable in any context where a computer-mediated task process is performed. In particular, any development environment in which data can be presented or modified through a number of different views is appropriate for this invention. Examples of such environments are the generation and modification of mailing lists in a word processing application, completion of web-page templates for website creation, or iTV applications.

The present invention provides standard or default window sets that are shipped with the product, the ability to associate a window set with an appropriate placeholder element (layout, state table, table, etc.) and to associate the desired window sets with a project. The window sets are exportable and importable to other projects and are easy to bundle with a project(s).

The present invention provides systems, methods and graphical user interfaces for creating interactive television applications. A template author creates a template application and assigns placeholder objects to display elements. An episodic creator creates an episodic application by making changes to display elements associated with a presented placeholder object.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIG. 1 is a diagram of an example system for implementing the present invention;

FIGS. 2A-G are screen shots of a graphical user interface executed by a system, such as that shown in FIG. 1, for performing template creation; and

FIGS. 3A-F are screen shots of a graphical user interface executed by a system, such as that shown in FIG. 1, for performing episodic project creation.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates a system 20 that includes computers 22 in communication with a storage device 26 over a public or private data network 24. The storage device 26 stores application information that is created and stored by authors and technicians using the computers 22.

When an application author develops a template application using a design tool (a graphical user interface (GUI)), a template placeholder is associated with a window set. A window set includes a subset of views that can be provided by the design tool. Each view is placed and sized as desired by the author. Window set meta-data is then associated with the application template. When the template is reused, an authoring tool (a GUI) displays the author-specified set of views

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with appropriate features and appearance according to the author's preferences. Examples of the GUIs are shown in FIG. 2A-G below.

In an iTV application program, a window set contains a users window configuration. The window set can be used to enhance user efficiency in completing a task or tasks. Window sets may be predefined for making basic tasks less confusing and increase usability. Also, a template author's job is made easier by allowing assignment of placeholder elements to a window set for a template project. This makes it simpler for the user who is modifying an episodic application, because the window configuration needed to make the necessary changes can automatically be shown and adjusted for easy access based on the element they have selected in the place-holders tab (in a status window), see FIG. 3A-F below.

A placeholder element is any tvscript element (i.e., object, object property, function, etc.) that can be marked for change. A placeholder list acts as a todo list. The user can mark elements that have not been finalized (graphics are a good example of this) as a placeholder and then check their place-holder list as they get updates and remove the placeholder status when final changes have been made.

A project set saves the data in the windows that are being viewed. The window configuration was stored in the registry as the current setup or saved separately in a window set. If the user changed their current window configuration and then loaded a project set, the data may not be directly available because the window that showed that information is no longer being viewed by the current window configuration. However, if the window configuration was saved with the project set information, then the window configuration for that project set will automatically display when that project set is loaded. Episodic Window sets are intended to reduce any confusion regarding what elements of an episodic project need to be updated.

FIG. 2A shows a screen shot of a first page 100 of the GUI that allows the author to create template applications (win-dow sets). The first page 100 includes a project type window 104. The project type window 104 allows a user to select between a standard project, an episode project, or a template project. The standard project is one where placeholders can-not be used to lock/unlock properties of objects. If a user makes a copy of standard project, they have full editing rights to change any aspect of it they wish.

In one embodiment, the template project may only be selected by authorized users, for example, a template author. Upon selection of the template project within the project type window 104, the GUI presents a second page 110 that includes a new project type window 112 that allows a tem-plate author to create and identify a new template, use an existing project as a starting point for a new template, or copy a stock profile or a custom profile for use in creating a new template.

After the template name and location information has been entered in the second window 110, as shown in FIG. 2B, the GUI presents a third window 120 as shown in FIG. 2C. The third window 120 is an initial template project page that presents windows based upon the information selected at the new project type window 112. In this example, a project window 126, a lay-out window 130, and a status window 132 are presented in a work space of the page 120. In this example, nothing is presented in the windows 126-132 because the template is empty and is waiting for the author to begin interaction.

FIG. 2D illustrates the page 120 after the author has begun creating objects and has begun the process of assigning place-holders. As shown in the lay-out window 130, the author has

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entered two blocks: A descriptive text block 138 and a change box 140. The change box 140 is a text box object. A project view allows the viewer to see the directory structure and organization of their project. The resource bin 150 lists all the externally referenced assets used in the application. In order to change a logo graphic the viewer will need to change the graphic file—generally by right clicking on that list item in the resource bin and selecting 'replace'.

Then, the author determines what objects included in the lay-out window 130 that they will allow episode creators to edit. This is done by selecting an object, such as the selection of the descriptive text block 138 as shown, then selecting a placeholder function 154 from a pull-down or pop-up menu 156. Selection of the placeholder function 154 allows the descriptive text box 138 to be editable by an episode creator and thus will appear in a placeholder list to that creator. Right click on the list item in the project view window.

FIGS. 2E and 2F illustrate saving what was created in FIG. 2D as a window set by activating a window set creation function 160 as activated from the pull-down menu of the menu bar of the window 120. Then, a naming window 162 is presented, as shown in FIG. 2F, in order to allow the author to name the present window set.

FIG. 2G shows a placeholder settings window 168. There is a default window configuration for each object type. So one sets the customer configuration for that particular object. The placeholder is the object's status—a parameter setting—and does not represent anything outside of that parameter. The author assigns the object as a placeholder, the author then assigns a window set configuration to that object.

FIG. 3A shows that an episodic creator has select an epi-sode project in the project type window 104. This presents the creator with a new project window 178 as shown in FIG. 3B. The creator enters new episode information and the filename of the template project into the new project window 178.

As shown in FIG. 3C, the episodic creator can view the placeholder types within a status window 182 of an episodic creation page 180. The user selects from any one of the placeholder types within the status window 182 in order to edit an associated element. The objects in the layout window appear after the user has double clicked on the list item in the project view.

FIG. 3D illustrates that a resource bin window 190 is pre-sented to the episodic creator after the user has selected the file tag placeholder. The resource bin window 190 allows the user to view features of the selected placeholder and make any changes to that element. The resource bin allows the user to change the graphical asset used in that object.

FIG. 3E illustrates an object properties window 184 that is presented to the creator upon selection of an object property label placeholder from the status window 182. The object properties window 184 allows the user to change object prop-erties such as background color, font alignment, position on screen. Essentially any property that has been identified by the template author as a property which may be changed.

FIG. 3F illustrates that the description text box 200 is editable by the episode creator after the creator has selected the object desc_txt placeholder from the status window 182. Only those defined as template authors can change any fea-ture of a placeholder object.

While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not lim-ited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

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What is claimed is:

1. A system for creating interactive television applications, the system comprising:

a template author system comprising:

    a display;

    a user interface; and

    a processor coupled to the display and the user interface, the processor comprising:

        a component for presenting a layout window on the display;

        a component for assigning one or more display elements to the layout window using the user interface;

        a component for assigning a placeholder object to at least one of the display elements using the user interface; and

        a component for saving the assigned display elements and placeholder object as a template application; and

a episodic creator system comprising:

    a display;

    a user interface; and

    a processor coupled to the display and the user interface, the processor comprising:

        a component for presenting a saved template application on the display;

        a component for presenting previously assigned placeholder objects and display elements on the display;

        a component for selecting a placeholder object using the user interface;

        a component for recording changes to one of the display elements that is associated with the selected placeholder object; and

        a component for saving the display elements as an episode application.

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2. The system of claim **1**, wherein the episodic creator system further comprises a component for updating status of the presented placeholder objects based on recorded changes to the display elements.

3. The system of claim **1**, wherein the components of the episodic creator system and the template author system are distributed across a network.

4. A graphical user interface (GUI) residing on a computer-readable medium for creating interactive television applications, the GUI comprising:

a template author component comprising:

    a component for presenting a layout window;

    a component for assigning one or more display elements to the layout window;

    a component for assigning a placeholder object to at least one of the display elements; and

    a component for initiating saving the assigned display elements and placeholder object as a template application; and

a episodic creator component comprising:

    a component for presenting a saved template application;

    a component for presenting previously assigned placeholder objects and display elements;

    a component for selecting a placeholder object;

    a component for recording changes to one of the display elements that is associated with the selected placeholder object; and

    a component for initiating saving the display elements as an episode application.

5. The graphical user interface of claim **4**, wherein the episodic creator component further comprises a component for updating status of the presented placeholder objects based on recorded changes to the display elements.

*   *   *   *   *

Exhibit E

US008682945B2

(12) **United States Patent**
Khader et al.

(10) **Patent No.:** **US 8,682,945 B2**
(45) **Date of Patent:** **Mar. 25, 2014**

(54) **METHOD AND SYSTEM FOR AUTHORING MULTIPLE APPLICATION VERSIONS BASED ON AUDIENCE QUALIFIERS**

(75) Inventors: **Aslam Khader**, Beaverton, OR (US); **Jeffrey Todd Harper**, Tualatin, OR (US); **Halstead Winship York**, Portland, OR (US)

(73) Assignee: **Ensequence, Inc.**, Portland, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 173 days.

(21) Appl. No.: **12/873,198**

(22) Filed: **Aug. 31, 2010**

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/509,363, filed on Jul. 24, 2009.

(51) **Int. Cl.**
G06F 17/00 (2006.01)
G06F 17/30 (2006.01)

(52) **U.S. Cl.**
USPC **707/899**

(58) **Field of Classification Search**
CPC G06F 9/544; G06F 9/4416; G06F 21/57;
G06F 21/577; G06F 21/575; G06F 21/64;
G06F 21/00; G06F 21/51; G06F 21/604;
G06F 21/606; G06F 21/645; G06F 9/445;
G06F 11/3672; G06F 17/00; G06F 21/105;
G06F 21/31
USPC 707/899; 725/61, 110, 112, 42, 135, 34,
725/46; 713/176, 189, 1; 726/23; 705/46
See application file for complete search history.

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Primary Examiner — Yicun Wu
(74) *Attorney, Agent, or Firm* — Kristine Elizabeth Matthews

(57) **ABSTRACT**

A computer system is used to create and distribute applications. An audience qualifier and a set of categories corresponding to the audience qualifier are selected. A master application template is selected. The master application template may be pre-certified. For each of the selected categories, an application instance is created from the master application template, where the modifications to the master application template for each category are determined at least in part by the characteristics of the category. Metadata describing the audience qualifier and category are associated with each application instance. The application instances may be certified. The application instances are distributed in accordance with the metadata.

17 Claims, 8 Drawing Sheets
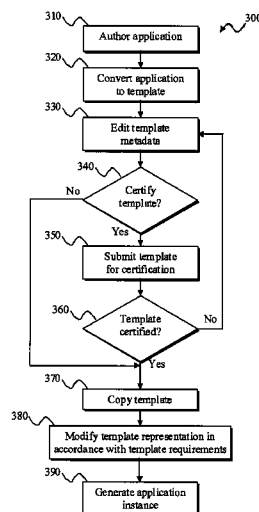
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Page 2

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100

110

Application
authoring
component

Application
source code

120

Template
authoring
component

130

Certification
authority

140

160

Copy of
application
template

Certified
application
template

150

Application
creation
component

170

Application
instance

180
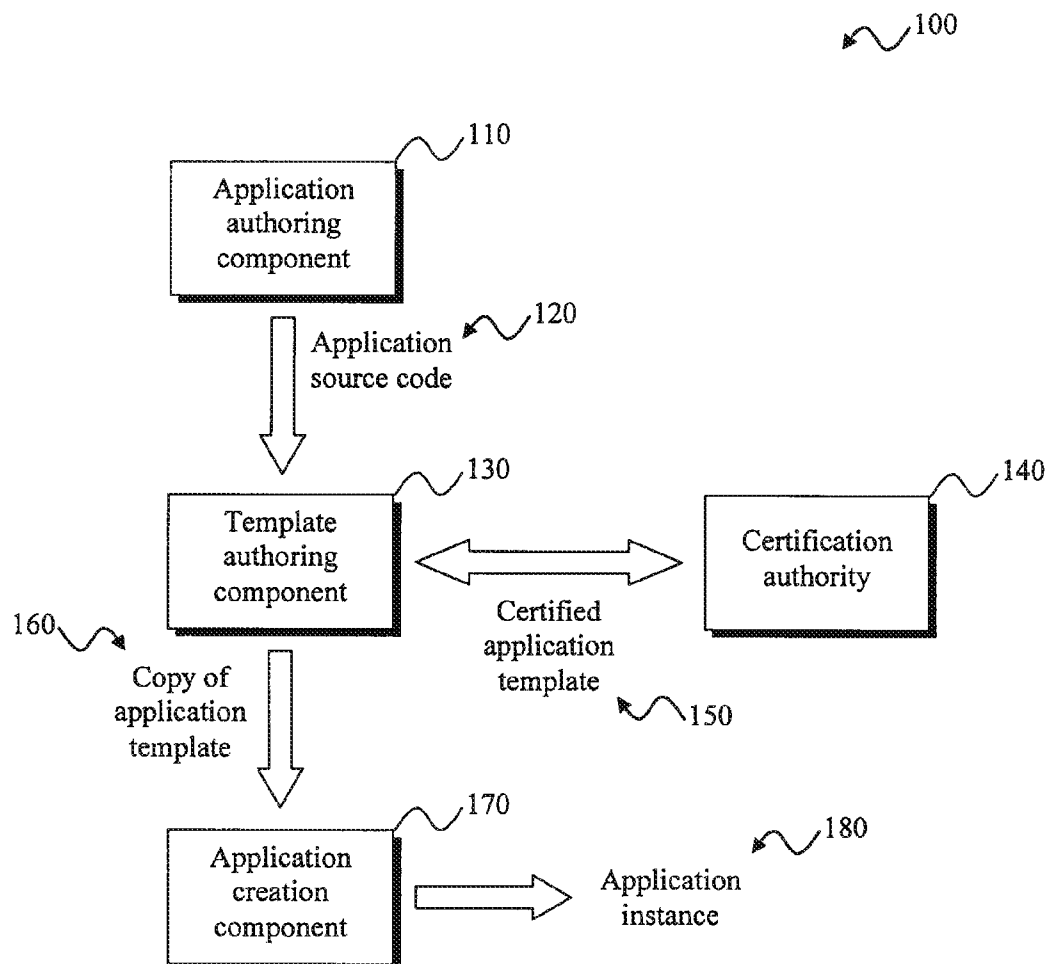
FIG. 1

```
201    <?xml version="1.0" encoding="utf-8"?>

202    <template>

203      <modify-property file="page1.tvb" object="text1" property="label"
           type="string">

204        <constraint text-max-length="28"/>

205      </modify-property>

206      <modify-variable file="page1.tvb" variable="myVar" type="integer">

207        <constraint range-min="0" range-max="10"/>

208      </modify-variable>

209      <modify-property file="page1.tvb" object="text1" property="hAlign"
           type="string">

210        <constraint valid-value="left"/>

211        <constraint valid-value="middle"/>

212        <constraint valid-value="right"/>

213      </modify-property>

214      <modify-resource file="myApp.tvr" resource="imageRes1">

215        <constraint valid-extension=".png"/>

216        <constraint valid-extension=".bmp"/>

217      </modify-resource>

218      <modify-cell file="data1.tvd" table="tbl1" row="2" col="3" type="intege

219        <constraint range-min="0"/>

220      </modify-cell>

221    </template>
```

FIG. 2

310 — Author application

320 — Convert application to template

330 — Edit template metadata

340 — Certify template? — No / Yes

350 — Submit template for certification

360 — Template certified? — No / Yes

370 — Copy template

380 — Modify template representation in accordance with template requirements

390 — Generate application instance

300

FIG. 3

400

410

Test application in accordance with all certification requirements

415

Application certified?

420

No → Signal failure

Yes

425

Select first certification requirement

430

Consider all possible combinations of allowable modifications

435

Requirement violated?

440

Yes → Log violation

No

445

More requirements?

450

Yes → Select next requirement

No

455

Violation logged?

460

No → Signal success

Yes

465

Report violations

FIG. 4

Template
database — 510

500

Application
template — 515

Audience
qualifier
database — 520

Audience
qualifier

525

Application
authoring
component — 530

Application
instances — 540

Certification
authority — 550

560

Application
server

580

Audience
qualifier/
category

Client — 570

Application
instance

590

FIG. 5

600

610 — Select application template

620 — Select audience qualifier

630 — Select qualifier categories

640 — Select qualifier category

650 — Create application instance from template based on characteristics of category

660 — More categories?

Yes

No

670 — Certify applications

680 — Distribute applications with audience qualifier and category metadata

FIG. 6

700

710
Receive query for
application including
audience qualifier
and category

720
Matching
qualifier?

730
Signal
failure

No

Yes

740
Matching
category?

750
Signal
failure

No

Yes

760
Select matching
application

770
Supply matching
application

FIG. 7

FIG. 8

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METHOD AND SYSTEM FOR AUTHORING MULTIPLE APPLICATION VERSIONS BASED ON AUDIENCE QUALIFIERS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 12/509,363, filed Jul. 24, 2009, entitled "METHOD FOR APPLICATION AUTHORING EMPLOYING A PRE-CERTIFIED MASTER APPLICATION TEMPLATE", the disclosure of which is herein incorporated by reference.

FIELD OF THE INVENTION

This invention relates generally to the modification of an application program to produce an upgraded version of the program, more specifically to the authoring and distribution of multiple versions of a program based upon audience qualifiers.

BACKGROUND OF THE INVENTION

The digital revolution has come to television. With the advent of digitally-encoded television, simple analog television (TV) receivers have been superseded by digital receivers capable of receiving and demodulating electrical signals, then extracting and decoding the compressed video and audio data streams mandated by the Motion Picture Experts Group (MPEG) encoding standards that form the basis for the Advanced Television Systems Committee digital television broadcast standard in the United States. These integrated receiver/decoder (IRD) devices contain analog and digital processing circuitry that is controlled by a central processing unit (CPU). IRDs also contain static and dynamic memory stores, interfaces, and a full complement of features that serve to enable a broad range of computational processing, including the execution of resident or downloaded applications software. When executing such applications, the IRD can generate graphics content that is overlaid onto the video content for display on an external television screen. Newer televisions incorporate the functions of the IRD, making them useful computation platforms capable of executing downloaded applications. More sophisticated IRDs may incorporate disc drive storage subsystems. These personal video recorders (PVRs) are capable of storing and playing back audio/video content.

A parallel body of work has aimed at developing standardized software execution environments that can enable the widespread deployment of interactive applications within the television broadcast infrastructure. This work has been complicated in the past by the wide variety of hardware and software deployed in IRDs, particularly set-top boxes (STBs) developed for the decoding and presentation of signals in cable TV distribution systems. The effort to develop a common Multimedia Home Platform (MHP) for consumer electronic devices led to the development of a Java-based standard for interactivity in the cable television realm, the Open Cable Application Platform (OCAP) now called tru2way. More recently, a separate standardization effort has produced the Enhanced Television Binary Interchange Format (ETV-BIF) standard for less-capable cable platforms.

The production and distribution of television content has historically been supported through the incorporation of advertising content into the broadcast stream. Advertisers pay for the right to broadcast advertising content at selected times

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in pairing with selected broadcast content, the cost to the advertiser reflecting the anticipated or potential audience that may view the advertisement. The selection of available time slots, or 'avails', by an advertiser is based in part of the expected target audience for the video content being shown on the given channel or service. An advertiser of products of particular interest to young people may prefer avails within content expected to interest those same young people.

Advertisers and broadcasters have developed a number of metrics or categories that can be used to describe a person or group of people who might consume a product or view a broadcast. Each audience qualifier (AQ) defines a qualitative or quantitative feature of a consumer, and divides the universe of consumers into a few categories. For example, 'gender' is an audience qualifier with two values, 'male' and 'female'. Another quantitative qualifier is 'age', which may be categorized into a series of ranges, for example 'under 12', '12 to 17', '18 to 34', '35 to 59', '60 and older'. A valid and useful audience qualifier is one for which two or more categories can be defined. Table 1 illustrates these audience qualifiers and associated categories:

TABLE 1

Audience Qualifiers and Associated Categories		
Audience Qualifier (AQ)	Gender	Age
Categories within AQ	Male	Under 12
	Female	12 to 17
		18 to 34
		35 to 59
		60 and older

Content creators, content distributers, and advertisers use AQs to characterize content and to quantify viewership. The Nielsen ratings company associates television viewership patterns with the AQs of each measured viewer or home. An advertiser will preferably run ads that appeal to children during Saturday morning cartoons, and ads that appeal to sports fans during Sunday afternoon football games.

When television content is distributed through terrestrial broadcast, networks distribute a common content stream to all viewers, and rely on aggregate statistics to predict the characteristics of the viewing audience for given video content.

What is required is a system that enables the creation and distribution of multiple versions of an application based on audience qualifiers.

SUMMARY OF THE INVENTION

The present invention provides a method and system for creating and distributing multiple versions of an application by selecting an audience qualifier; selecting at least two categories for the audience qualifier; selecting a master application template; creating for each selected category at least one application instance from the master application template, where the appearance and behavior of the application instance are determined at least in part by the characteristics of the category; associating application instance metadata with each application instance specifying the audience qualifier and the category corresponding to the application instance; and distributing each application instance in accordance with the associated application instance metadata.

In a further embodiment of the present invention, each application instance is submitted for certification prior to distribution.

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In a further embodiment of the present invention, the master application template is a certified master application template and each application instance is certified by virtue of the certification of the certified master application template.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIG. **1** depicts an exemplary system for creating a master application template.

FIG. **2** depicts an example of template metadata.

FIG. **3** depicts a flowchart delineating the steps of an exemplary method of creating an application from a master application template.

FIG. **4** depicts a flowchart delineating the steps of an exemplary method of certifying a master application template.

FIG. **5** depicts the components of an exemplary system that implements the inventive method.

FIG. **6** depicts a flowchart delineating the steps of authoring multiple versions of an application according to the inventive method.

FIG. **7** depicts a flowchart delineating the steps of distributing multiple versions of an application according to the inventive method.

FIG. **8** depicts an exemplary application broadcast system incorporating features of the inventive method and system.

DETAILED DESCRIPTION OF THE INVENTION

By way of overview, embodiments of the present invention provide a system and methods for authoring and distributing multiple versions of an application based on audience qualifiers.

As used herein, the term "application" is intended to refer generally to an experience of appearance and behavior engendered by a computing platform. An application is commonly authored in a source code language using an authoring environment, the source code being used to generate an executable version of the application for deployment to a computing platform to realize the desired experience.

As used herein, the term "executable application" is intended to refer to a body of digital information comprising executable instructions and data that when processed on a suitable computing platform yields appearance and behavior as intended by the creator of the application. An executable application may be encoded using native CPU instructions, interpreted byte codes, declarative data structures, or any combination of such encodings. An executable application may respond to external events by appropriate modification of appearance and behavior, as specified by the code and data comprising the executable application.

As used herein, the term "application representation" is intended to refer to a body of digital information that defines an application. The application representation may be one or more source code files, an in-memory representation of the application structure and function, or a database representation of the application structure and function. An application representation may be used to generate an executable version of the application.

As used herein, the term "metadata" is intended to refer to human-readable or binary content which is not part of an application representation or executable application, but which refers to attributes of an application representation or modifications that may be made to such attributes, or characterizes an executable application. Template metadata

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describe the allowable modifications of a template. Application instance metadata describe the audience qualifier and category associated with an application instance.

As used herein, the term "template" is intended to refer to an application representation and associated template metadata. The associated template metadata define allowable modifications to the application representation. The application representation for a template can be modified in accordance with template metadata associated with the application representation. The modified application representation may be used to generate an executable application. The phrases "application template" and "master application template" as used herein are synonymous with the term "template".

As used herein, the terms "certify" and "certification" are intended to refer to the process of validating the appearance and/or behavior of an executable application against a specified set of requirements, to determine that the application meets each and all of the specified requirements.

As used herein, the phrase "generate an application" is intended to refer to the process of converting an application representation into an executable application.

As used herein, the term "resource" is intended to refer to a body of binary data, exclusive of the source code or executable instructions of an application, which is used during the execution of the application to control the appearance or behavior of the application.

As used herein, the phrase "audience qualifier" is intended to refer to a qualitative or quantitative attribute of a member of an audience that can be unambiguously characterized for each audience member.

The term "category" as used herein in reference to an audience qualifier is intended to refer to a value, a set of values, or a range of values of the attribute of the audience qualifier. To be useful, an audience qualifier must have two or more categories, but the set of categories for an audience qualifier may not be inclusive of all possible members of the audience. The attribute of an audience qualifier may be a singular feature of an audience member, such as gender or age; or may be compound, comprising a combination of two or more singular features of an audience member, such as a combination of education and income. For a compound audience qualifier, the "category" designation comprises the combination of a value, set of values, or range of values for each of the singular features.

The term "select" as used herein with respect to an audience qualifier or a set of categories is intended to refer to the choice from among a predefined set of qualifiers or sets of categories, or the de novo definition of an audience qualifier or a set of categories corresponding to an audience qualifier. A set of categories is comprehensive if any audience member can be unambiguously associated with one and only one category. A set of categories is non-comprehensive if at least one potential audience member cannot be unambiguously associated with any category. Preferentially, the set of categories for an audience qualifier is comprehensive. A non-comprehensive set of categories can be made comprehensive by adding an additional 'other' category.

The various aspects of the claimed subject matter are now described with reference to the annexed drawings. It should be understood, however, that the drawings and detailed description relating thereto are not intended to limit the claimed subject matter to the particular form disclosed. Rather, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the claimed subject matter.

Furthermore, the disclosed subject matter may be implemented as a system, method, apparatus, or article of manu-

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facture using standard programming and/or engineering techniques to produce software, firmware, hardware, or any combination thereof to control a computer or processor based device to implement aspects detailed herein. The term "article of manufacture" (or alternatively, "computer program product") as used herein is intended to encompass a computer program accessible from any computer-readable device, carrier, or media. Additionally it should be appreciated that a carrier wave can be employed to carry computer-readable electronic data such as those used in transmitting and receiving electronic mail or in accessing a network such as the Internet or a local area network. Of course, those skilled in the art will recognize many modifications may be made to this configuration without departing from the scope or spirit of the claimed subject matter.

In many circumstances, a need exists to deploy multiple versions of an application that vary only slightly in their appearance and behavior. Templates have been one mechanism for simplifying the production of such variant applications. A template provides a basic framework, within which minor variations such as location, size and color of graphical elements can be modified to control appearance. An exemplary case where the use of templates is appropriate is in the production of standard-form interactive applications intended for broadcast with advertising content.

In some distribution systems such as cable or Internet Protocol television (IPTV), a distributer may supply two or more versions of content, and the selection of which version of content goes to a given viewing point may depend on the measured or inferred characteristics of the viewer(s) at that viewing point. For instance, the user of a subscription video-on-demand (VOD) system supplied over an IPTV network may see commercials interjected into the VOD content, where the commercial content is selected based upon known characteristics of the user such as geographical location, gender or income level.

Audience qualifiers may also be used to control or influence the presentation and execution of interactive applications in a television broadcast environment. For example, if a given application offers items for sale, the choice of which items to display to a given viewer might depend on the viewer's age, gender, and income level. This presents a challenge in authoring and properly distributing such applications so that the desired application content and behavior is displayed to a given viewer.

FIG. 1 depicts the components of an exemplary system 100 for authoring multiple versions of an application using a master template. An initial version of an application can be authored using an application authoring component 110. An example of a suitable application authoring component 110 is the Create™ ETV-BIF product developed by Ensequence, Inc. of Portland, Oreg. A further example of an application authoring component 110 is the TVWorks™ XML Development Kit developed by TV Works, LLC, of Mill Valley, Calif. In this exemplary system, the application representation is in the form of source code.

Once application source code 120 has been written, the application source code is converted into a master application template and master application template metadata are authored using a template authoring component 130. Template authoring component 130 serves to create and modify template metadata associated with the master application template. Template authoring component 130 may be any suitable text editor executing on a computer workstation, or may be a specialized editing environment configured to create and edit template metadata, for example by means of an

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application executing on a computer workstation or through a web services interface specialized for this purpose.

Following the authoring of the master application template, the master application template may optionally be submitted to a certification authority 140 for certification testing. The submission to the certification authority 140 may comprise the master application template content and an application generated from the master application template, for example by use of the default values of any modifiable attributes of the template. Examples of how the master application template content may be submitted to the certification authoring 140 include: (a) in the form of human-readable source code and template metadata files, (b) through a specialized application that visualizes an in-memory representation of the application representation and associated template metadata, (c) through access to a database storing the application representation and associated template metadata, or (d) by some other means that allows examination of the application representation and the allowable modifications of the representation. Certification authority 140 may certify the application, or may report problems with the certification testing. In the latter case, further modification of a master application template is performed using template authoring component 130.

The master application template can be used to create multiple application instances. When creating an application from a master application template, a copy 160 of the master application template is created, and an application authoring component 170 is used to modify the source code of the copy of the master application template within the constraints embodied in the master application template metadata. Application authoring component 170 may be any suitable text editor executing on a computer workstation, or may be a specialized editing environment configured to allow modification of the application template application representation in accordance with the requirements for modification embodied in the template metadata of the certified application template, for example by means of an application executing on a computer workstation or through a web services interface specialized for this purpose.

Once all modifications have been performed, application authoring component 170 is used to generate an executable version of the application instance 180.

A master application template comprises an application representation and associated template metadata that define the characteristics of the template. The template metadata may be incorporated into the application representation, or may be stored in a form distinct from the application representation. By way of illustration, the following description describes a set of template metadata tags suitable for a master application template, in which the application representation is source code written using the TVScript-BIF language as employed in the Create ETV-BIF application authoring product.

Briefly, TVScript-BIF is an object-oriented language for authoring declarative applications that execute on an ETV-BIF user agent. A TVScript-BIF application consists of: (a) an object hierarchy constructed from the various native objects defined by the TVScript-BIF language, (b) optional variables that contain static or dynamic values used during the execution of the application to control application appearance or behavior, (c) optional event function code that is executed in response to events, (d) optional data tables used to control application appearance or behavior, (e) optional resources used when executing the application, and (f) and optional signal and trigger data that may be sent to the application during execution. TVScript-BIF applications execute on

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compliant ETV-BIF user agents. The ETV-BIF binary format and the behavioral requirements for a compliant ETV-BIF user agent are defined by OpenCable specification OC-SP-ETV-BIF1.0-I04-070921 "Enhanced TV Binary Interchange Format 1.0" issued by Cable Television Laboratories Inc., Louisville, Colo., incorporated herein by reference.

The source code of a TVScript-BIF application comprises a series of human-readable files that: (a) define the hierarchy of object instances ("widgets") that make up the application, (b) declare the associated functions and variables used during the execution of the application, (c) specify the values of data tables incorporated into the application, (d) designate the source files for image and font resources used by the application, and (e) define the structure of the ETV-BIF resources to be created when generating the executable application.

In an exemplary implementation of a system for authoring a master application template from a TVScript-BIF application, template metadata are stored with the source code. The template metadata contain the specifications for how the template application source code may be modified when creating a version of the application from the template. In this exemplary implementation, the template metadata are encoded as an XML document.

FIG. 2 shows an example of the content of a template metadata file defining the allowable modifications in a TVScript-BIF application. Note that the line numbers in FIG. 2 are not part of the source content of the template metadata file but are included as reference markers for the following discussion. Furthermore, the formatting conventions illustrated in FIG. 2 are intended to clarify the structure and content of the example file.

In this illustrative example, line 201 signals that the contents of the file are compliant with the Extensible Markup Language specification, and that the content is encoded using the UTF-8 standard.

A 'template' tag at line 202 signals that this file contains a specification for the template metadata of a master application template.

A 'modify-property' tag at line 203 denotes a property of an object instance, the initial value of which may be modified. A 'modify-property' tag has: an attribute 'file' that names the source file containing the code for the declaration of the object instance whose property can be modified; an attribute 'object' that identifies the object instance within the source file whose property can be modified; an attribute 'property' that identifies the property within the object instance that can be modified; and an attribute 'type' that signals the type of the content to be provided as the value for the property. Examples of allowable content types are 'integer', 'float', and 'string'. The 'modify-property' tag at line 203 names the 'label' property of the 'text1' object instance contained in source file 'page1.tvb'. If this property is modified during the application creation process, the new content will be substituted for the original value of the named property when the application representation is modified.

The content type determines the allowable textual content that can be specified for the substitution. Example content types 'integer', 'float', and 'string' allow for different constraint models to be applied depending on whether the substitute content for the source file comprises an integer value, a real number value, or a sequence of characters, respectively. For example, the allowable textual content for an 'integer' content type is limited to string values that express an integer value, such as "12", "−365", and "0x7F3E9".

The 'modify-property' tag at line 203 contains a 'constraint' child tag at line 204. A 'constraint' tag defines restrictions on the content of the modification that can be made to the entity named in the parent tag of the 'constraint' tag. The 'constraint' tag at line 204 restricts the maximum number of characters that can be contained in the string provided to substitute for the 'label' property of the 'text1' object instance.

A 'modify-variable' tag at line 206 denotes a variable whose initial value may be modified. A 'modify-variable' tag has attribute 'file' that names the source file containing the code for the declaration of the variable whose initial value can be modified; attribute 'variable' that names the variable that can be modified; and attribute 'type' that signals the type of the content to be supplied as the value for the variable. The 'modify-variable' tag at line 206 names the integer variable 'myVar' declared in source file 'page1.tvb', and specifies a replacement value of type integer.

The 'modify-variable' tag at line 206 contains a 'constraint' tag at line 207. The 'constraint' tag at line 207 contains attributes 'range-min' and 'range-max' that specify a range of valid integer values that can be substituted for the initial value of the 'myVar' variable, in this case the range from 0 to 10 inclusive.

A second 'modify-property' tag appears at line 209, naming the 'hAlign' property of the 'text1' object instance contained in source file 'page1.tvb'. This tag contains three child 'constraint' tags at lines 210, 211, and 212. These 'constraint' tags list valid string values that may be substituted for the initial value of the 'hAlign' property. If a modification tag contains multiple 'constraint' tags, by default the substitution value must satisfy at least one of the constraints.

Other tags (not shown) can be used to modify the logical implications of one or more constraints. For example, a 'not' constraint containment tag can contain a constraint that must not be satisfied for the 'not' constraint to be satisfied. Logical combinations of constraints can be achieved by the use of 'and' and 'or' constraint containment tags that carry the corresponding Boolean logic implications. An 'and' tag can contain one or more 'constraint', 'not', 'and' and 'or' tags, all of which must be satisfied for the 'and' to be satisfied. An 'or' tag can contain one or more 'constraint', 'not', 'and' and 'or' tags, any of which must be satisfied for the 'or' to be satisfied.

A 'modify-resource' tag at line 214 signals a resource whose source property may be modified. In a TVScript-BIF application, resources are referenced through unique identifiers, each identifier being associated with a URI that defines the source file from which the resource is generated. A 'modify-resource' tag has attribute 'file' that names the source file containing the declaration of the resource identifier, and attribute 'resource' that names the resource identifier whose source property is to be modified.

The 'modify-resource' tag at line 214 contains two child 'constraint' tags at lines 215 and 216. These 'constraint' tags contain 'valid-extension' attributes that define allowable file extensions for a URI that is specified as the new source for the resource named in the 'modify-resource' tag.

A 'modify-cell' tag at line 218 denotes a cell within a data table, that is, a given row and column location within the data table, the value of which may be modified. A 'modify-cell' tag has attribute 'file' that names the source file containing the code for the data table, attribute 'table' that names the data table within the source file, attribute 'row' that signals the row within the table containing the cell, attribute 'col' that signals the column within the table containing the cell, and attribute 'type' that signals the type of the content to be supplied as the value for the data table cell.

The 'modify-cell' tag at line 218 contains a 'constraint' tag at line 219 that specifies a range of valid values that can be substituted for the initial value of the cell at row 2, column 3

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of data table 'tb11' in file 'data1.tvd'. The 'constraint' tag at line 219 specifies only a minimum value for the range. This signals that the range of valid values is any value greater than or equal to the minimum value, which in the example is zero.

The specific tags depicted in FIG. 2 are intended to be a representative but not limiting example of the types of modifications and constraints that might be specified in template application template metadata. For example, a 'constraint' tag that specified only a 'range-max' attribute would define a range that extended to any value less than or equal to the maximum value. For real values, ranges might be defined inclusive or exclusive of the end points. For string values, a constraint might list a regular expression that the replacement value must match. Other types of allowable modifications and allowable constraints will be evident to one skilled in the art.

The presence of template metadata stipulating allowable modifications and associated constraints on those modifications characterizes a master application template. Therefore, the process of authoring a template consists of creating the template metadata defining the set of modifications and associated constraints that are allowable when modifying the original application representation to create a new application based on the template. Attention is now directed to FIG. 3, which depicts a flowchart of an exemplary method of creating and utilizing a master application template to generate an application instance.

At a step 310, an application is authored. This step may be undertaken using any application authoring environment known in the art, the result being an application representation that defines the application appearance and behavior.

At a further step 320, the application is converted into a master application template by the addition of template metadata to the application representation. In the exemplary implementation described above with reference to FIG. 2, the application representation comprises one or more source code files in human-readable format, while the template metadata is stored in a separate XML document. In an alternative implementation, the application representation may be generated by creating an in-memory representation of the application structure and function, for example in the form of an object or a set of objects that correspond to the objects, properties, functions, and other elements of the executable application. This in-memory representation could be created by parsing source code, or by decompiling the contents of an executable application. In this alternative embodiment, the template metadata could be stored in an XML document associated with the original source code or the executable application, or the application representation could be serialized out to one or more disk files and the template metadata stored in an XML document associated with the serialized application representation. In yet a further alternative embodiment, the application representation could comprise a series of objects that correspond to the elements of the executable application, and the objects could be stored in a relational database. In this yet further alternative embodiment, the template metadata could be stored in the relational database in association with the objects comprising the application representation. Other forms of representation and storage will be evident to those skilled in the art.

At a further step 330, the master application template metadata are edited. The editing process comprises the creation, modification, rearrangement, and deletion of specifications of allowable modifications to the application representation, as exemplified by the modifications described above in reference to FIG. 2. The editing process further includes the creation, modification, and deletion of constraints on the allowable modifications, as exemplified by the constraints

described above in reference to FIG. 2. The editing process may be performed through a text editor, through an application interface specifically encoded to allow such editing, or by other means known in the art.

At a further step 340, a decision is made whether to certify the master application template. If the master application template is to be certified, at a further step 350 the master application template is submitted for certification. In accordance with the description above in reference to FIG. 1, the submission of an exemplary application generated from the template, along with the template metadata comprising the allowable modifications to the application representation, is made to a certification body. The certification process is described in greater detail below with reference to FIG. 4.

At a further step 360, the certification body returns a certification decision. If the master application template is not certified, further editing is performed at a step 330. If the master application template is certified, the certified master application template is available for use in creating a certified application.

Following the optional certification of the master application template, at a further step 370, a copy of the master application template is made, and an application representation formed therefrom, for use in creating a new application.

At a further step 380, the application representation of the copy of the master application template is modified in accordance with the template metadata contained in the master application template. Only those aspects of the application representation specified in the template metadata may be modified, and each such modification must be made in accordance with any constraints specified for the modification in the template metadata.

Once all desired modifications have been performed, at a further step 390 the modified application representation is used to generate an application instance. If the master application template has been certified, the resulting application can be denoted as certified without further analysis or testing by the certification body.

The operation performed at step 380 of modifying the application representation in accordance with the template metadata contained in the master application template may be performed using any suitable editing environment known in the prior art. For example, U.S. Pat. No. 6,590,589 describes one such system that would be adaptable to the performance of source code modification. Similarly, the on-Q Publish™ software product marketed by Ensequence, Inc., provides a suitable editing environment for this purpose.

Attention is now directed to FIG. 4, which depicts a flowchart of an exemplary process for certifying a master application template. At a step 410, an application submitted with the master application template is certified according to the conventional certification process for an application. At a step 415, the status of the application certification is determined. If the application failed certification, at a step 420 the certification failure is reported and the process terminates. If the application passed certification, at a step 425 the first certification requirement is selected. At a step 430, the appearance and behavior of the application for all allowable values of all allowable modifications are compared against the selected certification requirement. At a step 435, a determination is made if any of the allowable combinations of modifications violates the selected certification requirement. If the certification requirement is violated, at a step 440 the violation is logged. At a step 445, a check is made if at least one more certification requirement remains to be considered. If at least one certification requirement remains to be considered, at a step 450 the next certification requirement is selected, and

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step **430** is repeated. If no more certification requirements remain to be considered, at a step **455** a test is made if any certification requirement violation was logged. If no violation was logged, at a step **460** certification success is reported and the process terminates. If at least one violation was logged, at a step **465** all logged certification requirement violations are reported and the process terminates.

According to the teachings of the inventive method, a master application template can be used to create multiple versions of an application. FIG. **5** depicts the components of an exemplary system **500** on which the inventive method may be practiced.

An application database **510** contains one or more master application templates. In the inventive method, a master application template **515** is selected from the template database **510**. An audience qualifier database **520** contains definitions for one or more audience qualifiers. An example of an audience qualifier is 'gender'. Each audience qualifier has two or more categories associated with it which describe some or all of the potential users of an application. For example, if the audience qualifier is 'gender', the two categories 'male' and 'female' describe the entire set of potential users. Another example audience qualifier is 'age'. A set of categories for the audience qualifier 'age' may include '6-12', '13-17', '18-25', '26-39', and '40-65', where for each category the numbers represent the minimum and maximum inclusive ages of an age range. In this case, potential application users younger than 6 or older than 65 are not included in the available categories for this qualifier. In the inventive method, an audience qualifier **525** is selected from the audience qualifier database **520**. Alternatively, if a suitable audience qualifier **525** is not contained within the audience qualifier database **520**, a novel audience qualifier and associated set of categories may be defined within application authoring component **530**.

Once a master application template **515** and an audience qualifier **525** have been selected, an application authoring component **530** is used to create an application instance **540** for each category associated with the audience qualifier **525** by modifying at least one attribute of the master application template. For each application instance **540**, the number of modifications to the master application template and the values of the modified attributes are determined at least in part by the characteristics of the category associated with the application instance. The set of attributes modified for each application instance may be common to all categories, unique to each category, or common to some and unique to other categories.

Once the application instances **540** are created, the instances may optionally be submitted to a certification authority **550** for certification. If the master application template **515** is certified, the application instances are certified without the requirement for submission to certification authority **550**.

Application instances **540** are stored at an application server **560** with application instance metadata defining the audience qualifier and category for each application instance. When a client **570** forwards a request to application server **560** including audience qualifier and category data **580**, application server **560** examines application instances **540** and returns an application instance **590** matching the application qualifier and category.

In an exemplary implementation of the inventive system, application instance metadata may be expressed in the form of an XML tag or file encoding the audience qualifier and category. For example, if the audience qualifier is "gender"

and the category is "male", the application instance metadata might take the form shown in Table 2:

TABLE 2

Application Instance Metadata
<?xml version="1.0" encoding="utf-8"?> <audience-qualifier>   <feature name="gender" category="male"/> </ audience-qualifier>

An audience qualifier may also be constructed as a combination of singular features. For example, an advertising campaign might wish to distinguish among various audience groups based on a combination of gender and age. An application instance targeted at women between the ages of 25 and 35 might have application instance metadata of the form shown in Table 3:

TABLE 3

Application Instance Metadata
<?xml version="1.0" encoding="utf-8"?> <audience-qualifier>   <feature name="gender" category="female"/>   <feature name="age" category="25-35"/> </ audience-qualifier>

In an exemplary implementation of the inventive system, application instance metadata might be distributed with an application instance by means of a human-readable XML file that is stored at an application server **560** in association with the storage of the application instance.

FIG. **6** depicts an exemplary flowchart **600** of the steps of the inventive method for creating a set of applications. At a step **610** a master application template is selected. At a further step **620** an audience qualifier is selected. At a further step **630** a set of two or more categories is selected for the audience qualifier. The set of categories may be comprehensive or may be non-comprehensive.

At a further step **640**, a category is selected from the set of categories. At a further step **650**, an application instance is created appropriate to the category selected. As described above, creation of an application instance from a master application template may be accomplished by modifying one or more attributes of the master application template. In the inventive method, the selection of the one or more attributes to be modified, and the values assigned to the one or more modified attributes, is based at least in part on the characteristics of the category selected at step **640**. Once the one or more attributes modifications have been performed, an application instance is created from the modified master application template.

Once an application instance has been created for the selected category, at a further step **660** a test is made to determine if one or more further categories exist for the audience qualifier selected at step **620**. If so, steps **640** and **650** are repeated. If not, at an optional step **670** the application instances are submitted for certification. If certification is not required, or if the master application template selected at step **610** is certified and the modifications to the master application template made at step **650** are in accordance with the constraints specified for the master application template, step **670** need not be performed.

At a further step **680**, the application instances created at step **650** are distributed. In a preferred embodiment, the proper application instance is selected based on the metadata

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associated with the application instance and served to the end user alone. In an alternate embodiment, the application instance is served to the end user together with application instance metadata identifying the audience qualifier and category associated with each application instance.

Once a set of applications is created and associated with audience qualifier and category metadata, the applications can be distributed according to the inventive method. FIG. 7 depicts an exemplary flowchart 700 of the steps of a preferential implementation of a method for distributing the applications. In this preferential implementation, application instances and associated metadata are stored at an application server 560. At a step 710, application server 560 receives a request 580 for an application from a client 570. The request includes an audience qualifier and a category associated with the audience qualifier. In the case of an audience qualifier based on a singular feature, the request may name the feature and the category for that feature. In the case of an audience qualifier based on two or more singular features, the request may name each of the two or more singular features and the category for each feature. For example, to request the application instance associated with the application instance metadata depicted in Table 2, the request would name the feature "gender" and the category "male". As a further example, to request the application instance associated with the application instance metadata depicted in Table 3, the request would name the feature "gender" and associated category "female" as well as the feature "age" and associated category "25-35". In the latter example, the full category comprises the two sub-categories "female" and "25-35". The request may be conveyed using a wired or wireless protocol. The message content may be in any suitable human- or machine-readable form.

At a further step 720 a test is made to determine if application server 560 has any application instance with associated metadata matching the audience qualifier specified in request 580. If not, at a further step 730 application server 560 signals failure to client 570 and the process terminates. If application server 560 has one or more application with associated metadata matching the audience qualifier, at a further step 740 a test is made to determine if application server 560 has an application instance with associated metadata matching the application qualifier and the category specified in request 580. If not, at a further step 750 application server 560 signals failure to client 570 and the process terminates. If application server 560 has metadata matching the category, at a further step 760 application server 560 selects a matching application 590. At a further step 770 application server 560 supplies matching application 590 to client 570. The matching application may be supplied using the same wired or wireless protocol used to convey request 580, or through a different wired or wireless protocol. If the set of categories used to create a set of applications is comprehensive, execution of exemplary flowchart 700 will always result in an application being supplied in response to a valid request.

By way of further illustration of the inventive method and system, FIG. 8 depicts elements of an exemplary system 800 incorporating features of a preferred embodiment of the inventive method and system. System 800 is configured to author and deliver interactive television applications in conjunction with an advertising campaign. An advertiser wishes to present a television commercial accompanied by an interactive 'request-for-information' (RFI) application. RFI applications are to be broadcast in conjunction with an associated television commercial, and a user of an RFI application is given an opportunity to request further information about a specific product described and depicted by the application. In

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an exemplary case, a company produces and wishes to advertise personal hygiene products; for a male viewer, the RFI application will describe and depict a cologne product, whereas for a female viewer, the RFI application will describe and depict a feminine underarm deodorant product. In this application of the inventive method, the selected audience qualifier is 'gender', with the categories 'male' and 'female'. An author uses authoring system 810 to select an RFI master application template from template repository 820. Two versions of the RFI application are created from an RFI master application template. Each of the two application instances generated from the RFI master application template will depict an image and descriptive text corresponding to the image. When the application instances are created, the attribute values for the image resource and descriptive text will reflect the advertiser's intent, with the application instance for the 'male' category depicting a bottle of cologne and describing the scent of the cologne, and the application instance for the 'female' category depicting a can of underarm deodorant spray and describing the antiperspirant properties of the spray. The application instances are stored in an application server 830 with associated metadata defining the audience qualifier and category for each application instance.

When the commercial is to be presented, broadcast delivery system 840 acquires from asset delivery system 850 the audio/video content of the commercial to be broadcast. Broadcast delivery system 840 sends an application request 860 to application server 830 for an RFI application to be broadcast with the commercial. The request may be conveyed over a wired or wireless channel, and may use any standard or custom protocol sufficient for conveying the content of the request, which includes an audience qualifier and a category. If the commercial is being aired on a channel and at a time when the program content is likely to appeal to female viewers, for example on the 'Lifetime' channel during a weekday afternoon, broadcast delivery system 840 may request an application for audience qualifier 'gender' and category 'female'. If the commercial is being aired on a channel and at a time when the program content is likely to appeal to male viewers, for example on the 'ESPN' channel on a weekend afternoon, broadcast delivery system 840 may request an application for audience qualifier 'gender' and category 'male'. The audience qualifier and category data are incorporated into application request 860. In response to application request 860, application server 830 selects an appropriate interactive application instance 870 and delivers it to broadcast delivery system 840. The audio/video content and the interactive application are broadcast through a network 880 to receivers 890a, 890b, where the content may be viewed and the interactive application may be executed.

The features of database, authoring, server and distribution components as described herein may be provided by hardware, software, or a combination of hardware and software. Various components may be incorporated into one or more physical devices, or may be provided as wired or wireless network services. Those skilled in the art will realize that such variations in implementation do not depart from the spirit and scope of the invention. Delivery of content through a network may be accomplished by wired or wireless means, including terrestrial, satellite, cable, and telephone transmission, without departing from the intent of the inventive method and system.

The term "computer" is used herein to refer to any device with processing capability such that it can execute instructions. Those skilled in the art will realize that such processing capabilities are incorporated into many different devices and

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therefore the term "computer" includes PCs, servers, mobile telephone, personal digital assistants and many other devices.

The methods described herein may be performed by software in machine readable form on a storage medium. The software can be suitable for execution on a parallel processor or a serial processor such that the method steps may be carried out in any suitable order, or simultaneously.

The description acknowledges that software can be a valuable, separately tradable commodity. The description is intended to encompass software, which runs on or controls 'dumb' or standard hardware, to carry out the desired functions. It is also intended to encompass software which 'describes' or defines the configuration of hardware, such as HDL (hardware description language) software, as is used for designing silicon chips, or for configuring universal programmable chips, to carry out desired functions.

The steps of the methods described herein may be carried out in any suitable order, or simultaneously where appropriate. Aspects of any of the examples described above may be combined with aspects of any of the other examples described to form further examples without losing the effect sought.

While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

What is claimed is:

1. In a computer system providing an application authoring environment, a method of creating and distributing multiple versions of an executable application characterized by:

selecting an audience qualifier having a plurality of categories within the audience qualifier;

selecting at least a first one and a second one of the plurality of categories for within the selected audience qualifier;

in the authoring environment:

from a master application template comprising an application representation and template metadata, creating for each of the first one and second one of the plurality of categories at least one executable application instance having a specified appearance and behavior, wherein:

the appearance and behavior of each executable application instance are determined at least in part by characteristics of the associated first one or second one of the plurality of categories; and

each executable application instance is created by modifying at least one attribute of the master application template within a constraint embodied in the template metadata; and

associating application instance metadata with each executable application instance specifying the audience qualifier and category corresponding to the executable application instance; and

distributing each executable application instance in accordance with the associated application instance metadata.

2. The method of claim 1, further characterized by, in the authoring environment, submitting each executable application instance created from the master application template for certification prior to the distribution step.

3. The method of claim 1, further including the step of certifying the master application template prior to creation of the executable application instances, the executable application instances created from the master application template consequently having a certified status, wherein the step of certifying the master application template comprises:

generating a first executable application from the application representation;

determining that the first executable application meets all of a set of requirements for certification; and

determining that modifying each attribute of a plurality of attributes specified in the template metadata in accordance with all requirements for the modification of each attribute does not violate any of the set of requirements for certification.

4. The method of claim 1, further including:

storing the master application template in a repository of other such master application templates; and

retrieving the master application template from the repository into the authoring environment.

5. The method of claim 1, wherein the executable application instance created for the first one of the plurality of categories is created using a modified attribute value different from a modified attribute value used for creating the executable application instance created for the second one of the plurality of categories.

6. The method of claim 1, wherein:

one of the at least one modified attributes is an image resource or descriptive text; and

the image resource or descriptive text for the executable application instance created for the first one of the plurality of categories is different from the image resource or descriptive text for the executable application instance created for the second one of the plurality of categories.

7. The method of claim 6, wherein the audience qualifier is 'gender' and the first one and second one of the plurality of categories are 'male' and 'female'.

8. The method of claim 6, wherein the audience qualifier is 'age' and the first one and second one of the plurality of categories are different ages ranges.

9. The method of claim 1, wherein the step of modifying the at least one attribute of the master application template comprises assigning a values to the at least one attribute based at least in part on the characteristics of the associated first one or second one of the plurality of categories.

10. A system for creating executable applications wherein the executable applications are associated with a specified audience qualifier and category within the specified audience qualifier, the system comprising:

a master template retrieval component configured to retrieve master application templates from a master application template repository, each of said master application templates having at least one attribute that acts to regulate the appearance or behavior of executable application instances created from the master application templates and each of the master application templates comprising associated template metadata embodying a constraint associated with the at least one attribute;

a category selection component operable on the application authoring system and configured to allow an application author to select an audience qualifier and at least two categories within the audience qualifier; and

an executable application instance creation component configured to select a master application template, create for each of the categories at least one executable application instance from the master application template, wherein the appearance or behavior of the application instance is determined at least in part by characteristics of the associated category, and associate application instance metadata with each executable

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application instance describing the audience qualifier and category associated with the executable application.

11. The system of claim **10**, the master application template including a plurality of attributes, wherein each executable application instance created from the master application template includes at least a changed one of the plurality of attributes of the master application template.

12. The system of claim **10**, wherein a value of the at least one attribute of the master application templates for the executable application instance created for a first one of a plurality of categories is different from a value of the at least one attribute of the master application template for the executable application instance created for a second one of the plurality of categories.

13. The system of claim **12**, wherein the audience qualifier is 'gender' and the first one and second one of the plurality of categories are 'male' and 'female'.

14. The system of claim **12**, wherein the audience qualifier is 'age' and the first one and second one of the plurality of categories are different age ranges.

15. A computer system for application authoring and distribution comprising:

a selection component configured to select an audience qualifier and at least two categories for the audience qualifier;

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an authoring component configured to select a master application template comprising an application representation and template metadata, create for each of the categories at least one executable application instance from the master application template, wherein the appearance and behavior of the executable application instance are determined at least in part by characteristics of the associated category and the executable application instance is created by modifying at least one attribute of the master application within a constraint embodiment in the template metadata, and associate application instance metadata with each executable application instance specifying the audience qualifier and category corresponding to the executable application instance; and

a distribution component configured to distribute the executable application instances in accordance with associated application instance metadata.

16. The system of claim **15**, wherein the authoring component is further configured to submit each executable application instance for certification.

17. The system of claim **16**, wherein the master application template is a certified master application template and each executable application instance is certified by virtue of the certification of the certified master application template.

*   *   *   *   *

Exhibit F

ROKU (https://www.roku.com)   (https://www.roku.com/checkout)

Search Roku support   🔍

Roku Support (/index) >
How to: Using your Roku (/category/200889378--how-to-using-your-roku) >
Finding movies and TV shows >
How do I use More Ways to Watch on my Roku TV™?

How do I use More Ways to Watch on my Roku TV™?
Background

Your Roku TV includes an opt-in feature called **More Ways to Watch** that enables you to stream live broadcast shows from the beginning, find full episodes of shows you missed, discover similar shows and movies and see ads that are more relevant to you.

How does More Ways to Watch work?

More Ways to Watch is an element of the **Smart TV experience** created for your Roku TV. It uses Automatic Content Recognition (ACR) and other technology to collect information about the movie or TV show you are watching via devices connected to the Antenna TV and HDMI® inputs, including over-the-air broadcasts and cable/satellite set-top boxes.

> **Notes**:
>
> - More Ways to Watch is only supported in the United States.
> - More Ways to Watch is not enabled by default. To use the feature, you must enable the Smart TV experience during initial setup or later in the Settings menu.

◦ To use More Ways to Watch, your Roku TV must be underline activated and linked (/article/235180868-how-to-activate-your-roku-streaming-device) to your Roku account.

How do I use More Ways to Watch?

When you are watching a movie or TV show that is broadcast to the antenna or cable/satellite set-top box (connected to your Roku TV), your Roku TV may detect the content you are watching and determine that the same movie or show, or related content, is available from one or more streaming channels.

When your Roku TV is specifically switched to the Antenna TV input, program details appear briefly at the bottom of the screen each time you tune to an over-the-air channel. A More Ways to Watch indicator designated with a purple star is displayed when related content is available.

Alternatively, when your Roku TV is switched to the input where your set-top box is connected, a More Ways to Watch notification banner will appear for a few seconds when related content is available for the current program.

If you want to check for a More Ways to Watch indicator while watching a movie or show, you can press the **OK** button 🆗 on your Roku TV remote to recall the program details or the notification banner.

From either screen described above, you can press the **Star** button ✳
to see the viewing options.

What are the More Ways to Watch viewing options?

- **Watch from beginning** – Shows you which streaming channels offer the same movie or TV show you are watching. You can select your preferred streaming service and start watching the same movie or show from the beginning. This option is helpful if you started watching in the middle of the movie or show and would like to start from the beginning.
- **More episodes** – Lets you jump to the episode list of the current season of the TV series you are watching. From there, you can navigate to all available episodes in all available seasons within the streaming channel you select.
- **More like this** – Displays movies or TV shows that have similar characteristics to the program you are watching. You can highlight a show, discover which streaming channels offer it, how much it costs to watch on those channels, and then start watching.

How do I opt in?

Smart TV experience is not enabled when you first set up your Roku TV or when the software on your Roku TV is updated to include this feature. The first time you select the Antenna TV or cable/satellite set-top box input, your Roku TV presents the option to enable Smart TV experience. You can opt in by checking the box.

By opting in, you give Roku permission to collect information about the programs you watch. If you choose to opt in and later decide you no longer want to use the Smart TV experience, you can disable the feature any time, but note that the viewing information that was collected while it was enabled will be retained by Roku and made available to third parties such as measurement providers and will continue to be used. If you decide not to opt in, you can enable the feature later.

Roku adheres to a strict privacy policy with respect to customer personal data which can be found at roku.com/legal (https://www.roku.com/legal).

How do I enable or disable More Ways to Watch?

More Ways to Watch is not specifically enabled or disabled on its own; you must enable or disable Smart TV experience. To do this, visit the Settings menu on your Roku TV.

1. Press the **Home** button 🏠 on your Roku TV remote.
2. Scroll up or down and select **Settings**.
3. Select **Privacy** and then select **Smart TV experience**.
4. Use your Roku TV remote to enable or disable the following options:

   - **Use info from TV inputs** – Press the **OK** button 🆗 to select or clear the check box. Press the **Star** button ✳ to see detailed information about how Roku collects information to enable this feature.
   - **Enable auto notifications** – If you select the check box, More Ways to Watch notifications appear at the bottom of the screen for a few seconds when switched to the cable/satellite set-top box input. If you would rather not see notifications, which usually appear one time per day on the input, clear the check box.

Using Smart Guide to find streaming options

Smart Guide is an electronic program guide that is available anytime you watch an over-the-air movie or TV show on the Antenna TV input. It fills the bottom portion of the screen with a grid listing your available channels and the programs airing on each channel. Upcoming programs can be viewed 14 days in advance, and programs that already aired can be browsed 7 days in the past. After you opt in to Smart TV experience, some programs may display the More Ways to Watch indicator as seen in the example below.
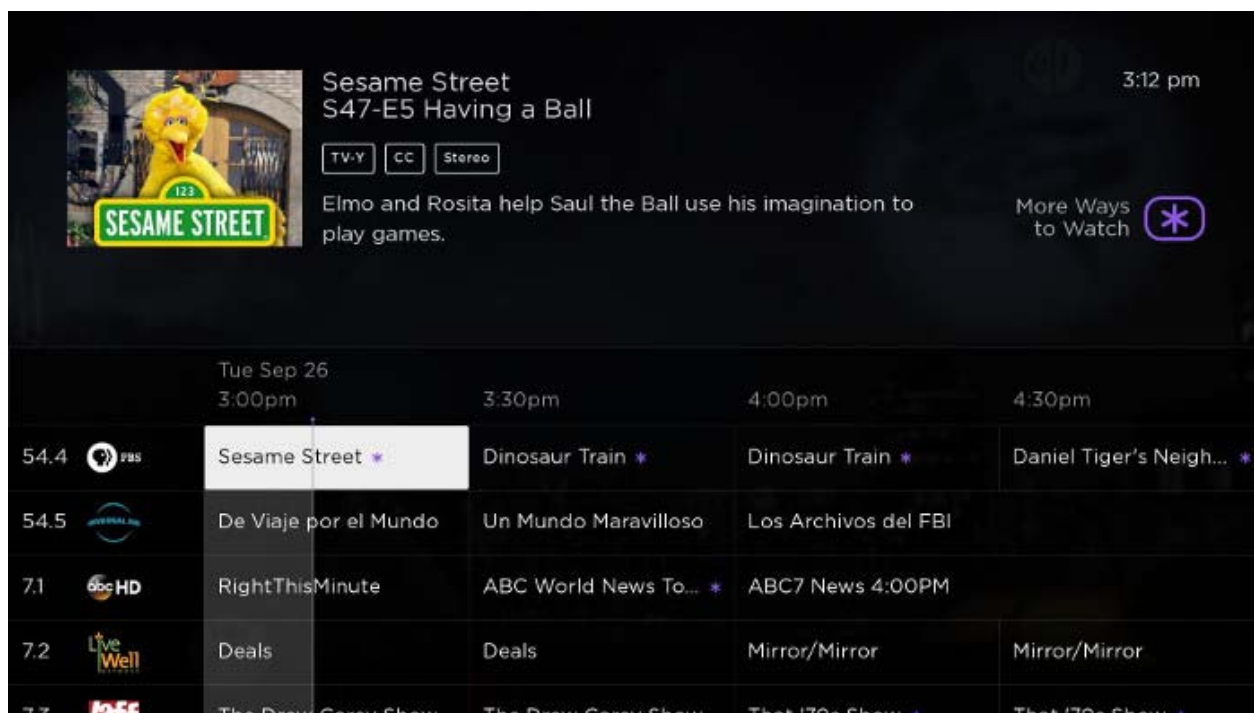
When you highlight a program displaying the More Ways to Watch indicator, you can press the **Star** button ✳ to see additional viewing options.
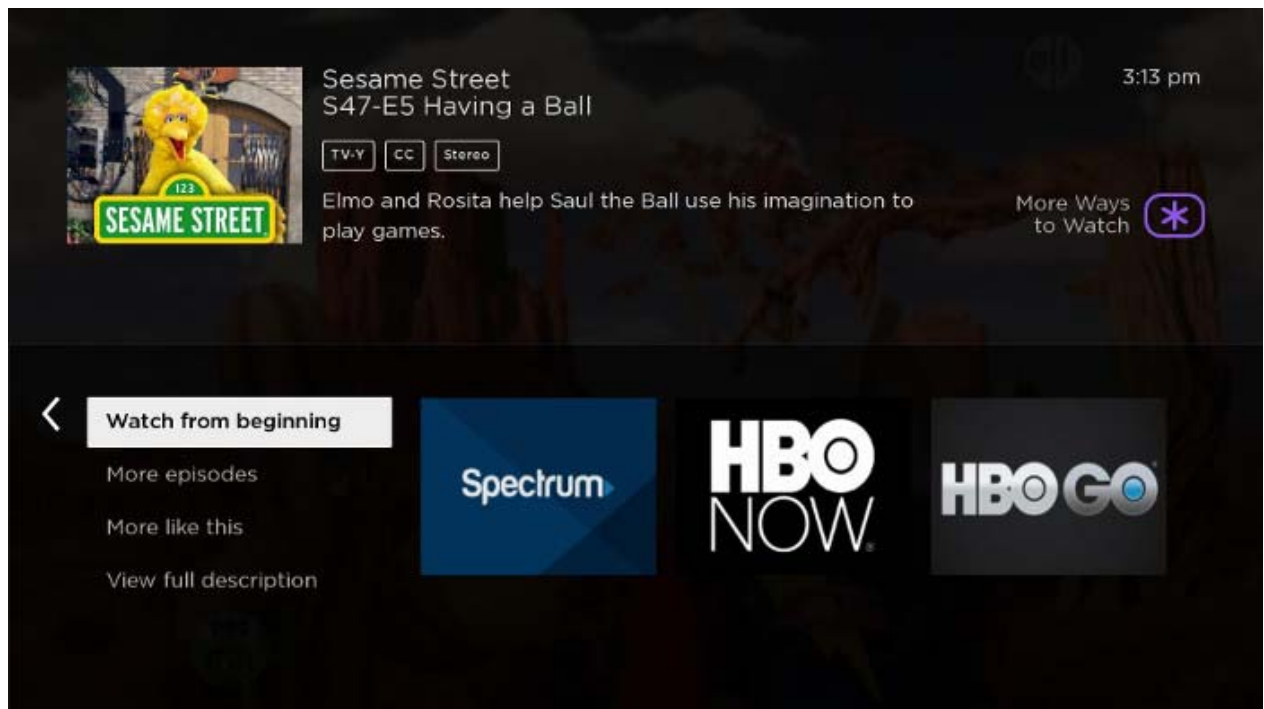
Learn more about using Smart Guide (/article/115012658287) on your Roku TV.

Yes   No

Contact customer support(/contactus)

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Exhibit G

Roku TV™

User Guide

Version 8.0

For U.S. and Canada

English

Illustrations in this guide are provided for reference only and may differ from actual product appearance.

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Roku, Inc.
150 Winchester Circle
Los Gatos, CA 95032

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Contents

Welcome

Congratulations on the purchase of your new Roku TV! Discover the joy of endless entertainment. After it's set up, you'll be able to access a world of streaming content channels that may include paid subscription channels like Netflix or free channels like YouTube, Crackle, CNET and literally thousands more.

Important: *Your TV receives automatic updates from time to time, enabling new content and features. This edition of the User Guide describes Roku TV version 8.0. To determine the current version of your Roku TV, go to Settings > System > About after you complete Guided Setup.*

The new standard in Smart TVs

Welcome to TV like you've most likely never seen before—a home screen that you can personalize with your favorite devices and streaming channels. Choose from hundreds of thousands of streaming movies and TV episodes, plus music, sports, kids, family, international and much more. You should never run out of things to watch.

Note: *A paid subscription or other payments may be required for some channel content. Channel availability is subject to change and varies by country.*

Get the most out of your new TV

Follow these simple steps to get the most out of your new TV.

1. Connect to the Internet
    -   It's simple, it's easy, and it will unlock a world of entertainment. All you need is a network connection. There are hundreds of free streaming channels, paid subscription services like Netflix and Spotify, and convenient ways to rent or buy a favorite film or show with, for example, Google Play.

2. Pick your favorite streaming channels
    -   Find the entertainment you love. From the latest blockbuster movies to your favorite TV shows, with tons of live sports, a broad selection of music streaming channels, popular programming in a dozen international languages, 24x7 live news and so much more, your new Roku TV has your sweet spot. A paid subscription or other payments may be required for some channels.

3. Find Antenna TV shows in the Smart Guide
    -   *Only in the United States*, use the Smart Guide to see not only what's on TV right now, but what was on up to a week ago, and what will be on in the coming two weeks. And for many over-the-air programs, if you start watching the program after it is already in progress, or you see something you missed in the Smart Guide, you can use More Ways to Watch to find streaming channels where you can see the show from the beginning, find other episodes, or entire seasons of the show, if applicable.

4. Use Roku's Smart TV experience to discover More Ways to Watch on other inputs
    -   *Only in the United* States, When watching programs from a cable box, Blu-ray player, or other source connected to the HDMI® or AV inputs, keep an eye out for a notification of streaming channels that offer the program you're currently watching and, if applicable, other episodes, the entire series, or other programs with similar themes.

5. Personalize your Home screen
    -   Put your favorite streaming channels, and TV inputs front-and-center on the Home screen. No more flipping through inputs or wading through complicated menus. You can even customize the names of each input and move tiles around so your most-often used devices and streaming channels are only a click away.

6. Search for your favorite movie, TV show, actor, or director

- Once you're connected to the internet, you can easily search across top streaming channels and Antenna TV channels. Search by movie or TV show title, actor or director—all from one place. Search by typing words or phrases using the on-screen keyboard or on your mobile device or, *only in the United States*, speak words or phrases in a conversational tone using Voice Search. Some channels and content require payment.

7. Pause live TV

- Pause, resume, fast forward, and rewind TV shows. Simply connect your own USB drive with 16GB or bigger capacity to the TV and pause live TV for up to 90 minutes.

  Note: *Live TV Pause is available on digital TV shows received on the Antenna TV input, and only when the TV is linked to a valid Roku account.*

8. Control your TV with voice commands

- *Only in the United States*, use your Roku Voice Remote (select models), Enhanced Voice Remote (select models), or the free Roku mobile app to control your Roku TV. Use conversational voice commands to search for programs by title, actor, director, or genre. Also use voice commands to launch streaming channels, switch inputs, change Antenna TV channels, or open the Smart Guide.

9. Send your personal media to the big screen

- Send personal photos, videos, and music from your compatible smartphone or tablet to the TV screen in just a few taps. Plus, with certain channels, such as Netflix and YouTube, you can send movies, shows, sport highlights, and more directly to your TV.

10. Follow movies coming soon

- Use My Feed to choose from and follow a list of upcoming movies, and then watch for alerts each time one of your followed movies becomes available or changes price.

11. Take charge with a smartphone or tablet

- Control your TV with the included remote or from your compatible smartphone or tablet with the free mobile app for iOS® and Android™ mobile devices[*]. Browse channels, view My Feed, listen to audio from Antenna TV and streaming channels. Search more easily using a your mobile device's keyboard and, *only in the United States*, Voice Search.

- Mirror your compatible smartphone or tablet on your TV. Share videos, photos, web pages, and more from compatible devices.

12. Connect your Roku TV to networks found in hotels and college dorms

- You can temporarily link the TV to your smartphone or table to agree to any terms, enter codes, or provide required information before you can get Internet access.

  Note: *Using your Roku TV on a restricted public network requires wireless availability and use of your network-connected smartphone, tablet, or computer to authenticate access to your account. You must use your Roku TV remote to initiate the connection process. Streaming content might be limited due to your geographic location or because of restrictions imposed by the network host.*

  Go to support.roku.com for device compatibility information.

Let's get started.

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[*] *IOS® is a trademark or registered trademark of Cisco in the U.S. and other countries and is used under license. Android™ is a trademark of Google Inc.*

Connections and setup

Refer to your TV's Quick Start Guide or other provided documentation to for model-specific information about attaching the base or a wall mount and making connections to AC power and to your other audio/video devices. The following information applies to all Roku TV models.

Connecting an antenna, cable, or satellite box

If you are using an antenna, CATV cable without a set-top box, or a cable or satellite box that has only an antenna output, connect a 75-ohm coaxial cable (not provided) from the device to the ANT/CABLE input on the TV.

Tip: *If you are using an antenna with a 300 ohm twin-lead cable, you need to use a 300-to-75 ohm adapter (not provided) to adapt the twin-lead cable to a connection that is compatible with the TV's antenna input.*

Tip: *If you receive your TV stations through a set top box from a cable or satellite TV provider, connect it to the TV using the best connection method available. From most to least desirable:*

- HDMI® input – Digital HD and SD video
- AV input – analog SD video
- Antenna input – analog SD video using NTSC

Connecting external equipment with a composite AV video cable

If the best connection available on your device is AV or composite video output, connect it to the TV using a composite AV cable (not provided). Composite AV cables typically have three RCA-type plugs on each end, color coded as follows:

- Yellow – Video
- Red – Audio, right channel
- White or black – Audio, left channel

Connect each plug to the corresponding connector on the device and on the TV.

Note: *Select models have an AV Input that looks like a headphone jack. Use the breakout cable (included) to adapt this input to the three RCA-type plugs on your composite cable.*

Connecting external equipment with an HDMI® cable

If possible, connect your devices using HDMI® cables (not provided). They help to provide the best video quality and also carry audio signals, so that only one cable is needed. For better picture quality, we recommend that you use cables designated as High Speed HDMI® Cables.

Tip: *You might need to configure the device to send its signal through its HDMI® connector.*

The connector labeled HDMI IN (ARC) has the additional ability to use the audio return channel to send digital audio to a receiver or sound bar, as explained in [Connecting an AV receiver or digital sound bar](#).

Connecting headphones or analog sound bar to the TV

You can connect headphones or an analog sound bar (not provided) to the TV's headphone jack.

Tip: *Inserting a plug in the headphone jack disables the sound from the TV's built-in speakers.*

Warning: *Loud noise can damage your hearing. When using headphones, use the lowest volume setting on your headphones that still lets you hear the sound.*

Select models also have an audio line out connection that is not affected by TV volume or mute settings and does not disable the TV speakers. Use this connection when you want to use your amplifier or sound bar to control the TV volume. To turn off the TV's built-in speakers, in the Home screen menu, navigate to Settings > Audio > TV speakers and change the setting.

Connecting headphones to the Roku Enhanced Voice Remote

Select Roku TVs come with the Roku Enhanced Voice Remote. On these models, you can connect headphones to the jack on the left side of the remote.

Tip: *Inserting a plug in the remote's headphone jack disables the sound from the TV's built-in speakers or attached receiver or sound bar. The volume and mute controls on the right side of the remote adjust the volume level of the connected headphones.*

Warning: *Loud noise can damage your hearing. When using headphones, use the lowest volume setting on your headphones that still lets you hear the sound. You might notice that connecting headphones to your remote shortens the remote's battery life somewhat.*

Connecting an AV receiver or digital sound bar

You can enjoy Dolby Audio™ multichannel sound from your TV if you connect a digital amplifier or sound bar (not provided) in either of two ways:

- Digital optical audio out (S/PDIF) – Connect a TOSLINK optical cable (not provided) from the TV to the Optical input on your receiver or sound bar.
- HDMI® ARC – Connect an HDMI® cable (not provided) from the HDMI (ARC) connector to the HDMI® input on your receiver or sound bar. This connection uses the Audio Return Channel (ARC) feature of the HDMI® specification to output sound from the TV to a compatible device. To use this feature, you must configure the TV to enable HDMI® ARC, as explained in [Enable HDMI® ARC](#).

7

Preparing for Internet connectivity

If you want to watch streaming content and take advantage of the cool features of your Roku TV, connect it to the Internet through a wireless modem/router or a wireless access point (not provided). The TV has a built-in wireless LAN adapter.

Note: *The TV supports only its internal wireless network adapter—it does not support the use of a USB network adapter.*

Select 4K models have wired in addition to wireless network connectivity. To use the wired network connection, connect an RJ-45 Ethernet cable (not provided) from the jack on the back of your TV to your network router or switch. The wired connection supports both 10 Base-T and 100 Base-T Ethernet.

AC power

Plug your TV into a power outlet. You can tell that the TV has power because the status light on the front of the TV lights up when the TV is off.

The topic Status light explains how the status indicator shows what is happening with the TV.

Roku remote batteries

Open the back of your Roku remote and insert the included batteries, observing the proper orientation as indicated in the battery compartment. Reattach the back cover.
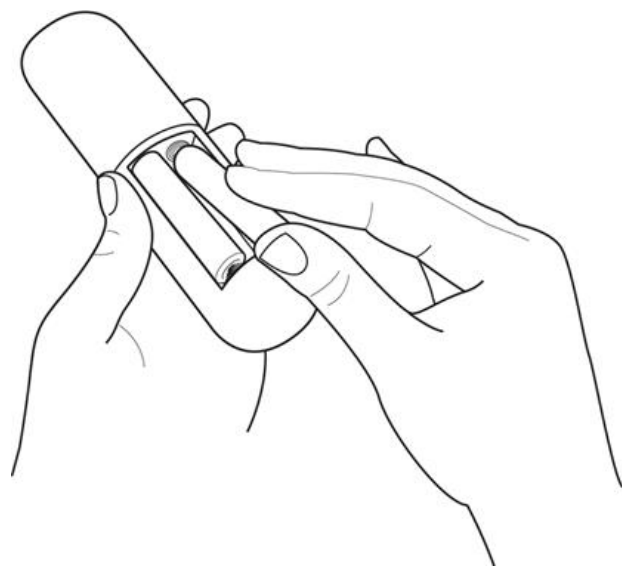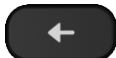
Roku TV remote
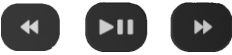
Use the following information to identify the buttons on your Roku remote.
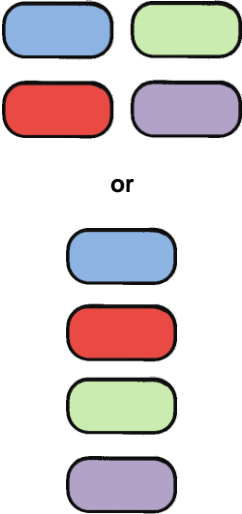
Note: *Certain remote buttons and features vary by model. Your remote might not have all buttons or features listed.*

- *If your remote has a microphone button 🎤 just below the purple pad, then you have a Roku Voice Remote.*
- *If your remote has a headphone jack on its left edge, then you have a Roku Enhanced Voice Remote.*

The Roku voice remotes have additional capabilities as described in the following table.

BUTTON	FUNCTION	DESCRIPTION
⏻	POWER	Turns TV on and off.
←	BACK	• Menu: Goes back to previous menu/screen. • Home screen tile: Moves highlight back to the Home screen option. • Watching Antenna TV or a TV input: Returns to Home screen. • Playing streaming content: Stops playing stream and returns to the previous menu or screen. • Browsing streaming content: Goes to the previous level in the content tree.
⌂	HOME	Immediately returns to the Home screen.
⌃ ‹ OK › ⌄	PAD	• LEFT/RIGHT/UP/DOWN moves the highlight in the corresponding direction. • OK selects the highlighted option. While watching TV: • UP/DOWN changes channel. • LEFT displays the Smart Guide (connected mode) or channel list (non-connected mode). • LEFT/RIGHT *only on TVs operating in non-connected mode,* while in the channel list switches between All Channels and FAVORITE CHANNELs. • OK while in the channel list selects the highlighted channel. While watching live TV: displays the program information banner.

BUTTON	FUNCTION	DESCRIPTION
or	VOICE SEARCH **and** VOICE COMMANDS	*Only in the United States on select models with Roku voice remotes.* Hold and say the name of a movie, TV show, actor, or director to search across many streaming and Antenna TV channels. Say a command to start streaming, change a channel, and more. For more information, go to: go.roku.com/voicesearch
	GAME MODE	*Select models.* Displays a banner showing the current Game mode or Not available at this time. Subsequent presses toggle Game mode. When On, the TV performs less image processing and has less input lag, producing a better experience with action games. *Available only for HDMI and AV inputs.*
	INSTANT REPLAY	*Select models.* Streaming programs that support this feature and Antenna TV channels: if Live TV Pause is enabled, jumps back a few seconds with each press and resumes playing. Broadcast TV: If Live TV Pause is disabled, jumps to previous channel. When using an on-screen keyboard: Backspaces in the text you are entering. Smart Guide: Returns to the current day and time.
	SLEEP	*Select models.* Displays a banner showing the remaining sleep time, if any, or Sleep timer is off. Subsequent presses cycle among the preset sleep time intervals. Once set, the sleep timer remains in effect regardless of what you are watching.
	MEDIA PLAYBACK CONTROLS	Rewind, pause, play, and fast forward streaming content and Antenna TV channels (if Live TV Pause is enabled). Press REWIND or FAST FORWARD one, two, or three times to control the speed of the operation. REWIND and FAST FORWARD also jump backward and forward one page at a time when viewing long lists, such as when you are browsing Antenna TV shows in the channel list or Smart Guide (U.S. only).

BUTTON	FUNCTION	DESCRIPTION
✱	OPTIONS	Displays additional options when available. On-screen hints let you know when this button is active.
or	PRESET CHANNEL SHORTCUT	Dedicated buttons show the logo of a preset streaming content provider. Dedicated content providers vary by model and region. Pressing a button: • Displays the streaming channel's main page if you have already added the channel to your Home screen. • Displays the streaming channel's sign-up page if you have not already added the channel.
	VOLUME/MUTE	Located on the right edge of the remote. Increases/decreases volume and mutes the TV sound. Note: *If the TV is muted, pressing VOLUME UP unmutes. Pressing VOLUME DOWN does not unmute the sound.*
	HEADPHONE	*Select models with Roku Enhanced Voice Remote.* Connect headphones to the jack on the left edge of the remote to listen privately. Plugging in headphones mutes the TV speakers.

Panel buttons

Your TV has a set of panel buttons that perform simple control functions. The TV panel buttons are not a substitute for the remote, as they do not give you access to all TV functions.

Depending on model, your TV model has one of several different panel button designs. Choose the one that applies to your TV from the following list:

- [Single button](#)
- [Three buttons](#)
- [Game-pad style joystick](#)
- [Four buttons](#)
- [Five buttons (with mute)](#)
- [Five buttons (without mute)](#)
- [Seven buttons](#)

Single button

If your TV has this style of panel button, you can perform the following functions:

- Turn TV on: short press.
- Display the Input List: short press when TV is on.
- Select the next input in the Input List: short press while the TV is showing the Input List.
- Dismiss the Input List without changing inputs: no press.
- Turn TV off: long press.

Short press = less than two seconds

Long press = more than two seconds

No press: = no press within two seconds

Three buttons

If your TV has this style of panel buttons, you can perform the following functions:

- Turn TV on: middle button, short or long press.
- Volume up: right button when Input List is not active.
- Volume down: left button when Input List is not active.
- Display Input List: middle button, short press when TV is on.
- Highlight next input in the Input List: right button when Input List is active.
- Highlight previous input in the Input List: left button when Input List is active.
- Select highlighted item in the Input List: middle button, short press, or no press.
- Turn TV off: middle button, long press.

Short press = less than two seconds

Long press = more than two seconds

No press: = no press within four seconds

Game-pad style joystick

If your TV has this style of panel button, you can perform the following functions:

- Press in: Toggle between power ON and Standby.
- Press up or down: Increase/decrease the volume.
- Press left or right: Switch inputs. Each press moves the highlight up or down one item. Pausing for a few moments selects the highlighted item.

Four buttons

If your TV has this style of panel buttons, you can perform the following functions:

- Power: Turns the power on and off.
- Input: Selects among TV inputs. Each press moves down one item. Pausing for a few moments selects the highlighted item.
- Volume +: Increases the volume.
- Volume –: Decreases the volume.

Five buttons (with mute)

If your TV has this style of panel buttons, you can perform the following functions. Note that the order of the buttons might vary from model to model. Examine the panel button labels to determine your TV model's layout.

- Power: Turns the power on and off.
- Input: Selects among TV inputs. Each press moves down one item. Pausing for a few moments selects the highlighted item.
- Volume +: Increases the volume.
- Volume –: Decreases the volume.
- Mute: Mutes and unmutes the sound.

Five buttons (without mute)

If your TV has this style of panel buttons, you can perform the following functions. Note that the order of the buttons might vary from model to model. Examine the panel button labels to determine your TV model's layout.

- Power: Turns the power on and off.
- Input +: Selects the next TV input. Each press moves down one item. Pausing for a few moments selects the highlighted item.
- Input -: Selects the previous TV input. Each press moves up one item. Pausing for a few moments selects the highlighted item.
- Volume +: Increases the volume.
- Volume –: Decreases the volume.

Seven buttons

If your TV has this style of panel buttons, you can perform the following functions. Note that the order of the buttons might vary from model to model. Examine the panel button labels to determine your TV model's layout.

- Input: Selects among TV inputs. Each press moves down one item. Pressing Channel + or Channel – moves the highlight up or down. Pausing for a few moments selects the highlighted item.
- Channel +: Moves the highlighted item up in the current menu.
- Channel –: Moves the highlighted item down in the current menu.
- Volume +: Increases the volume.
- Volume –: Decreases the volume.
- Mute: Mutes and unmutes the sound.
- Power: Turns the power on and off.
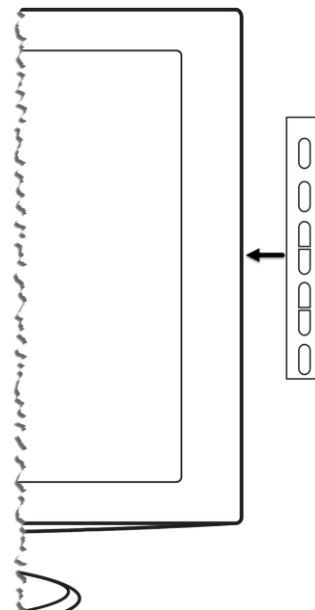
Guided Setup

With the preliminaries out of the way, it's time to turn on your TV. As the TV starts for the first time, it leads you through Guided Setup, which configures the TV before you start to use it.

During Guided Setup, you'll:

- Answer a few questions
- Provide network connection information
- Get a software update
- Link your TV to your Roku account.
- Connect devices such as a DVD player, game console, or cable box.

Starting Guided Setup

To start Guided Setup, press the POWER button on the remote to turn on your TV.

Note: *Guided Setup normally runs only once, the first time you turn on your TV. If you need to run Guided Setup again, you'll have to perform a factory reset, as explained in Factory reset everything.*

When you first turn on your TV, it will take a few seconds to get itself ready. You'll notice the following things happening:

1. The status light blinks every time the TV is busy doing something; in this case it's powering up and getting ready for you.

2. The power-on screen appears and the status light blinks slowly for a few more seconds. The power-on screen shows a brand logo while the TV starts up.

3. After a few seconds, Guided Setup starts.

Completing Guided Setup

Follow these steps to complete Guided Setup. At this point, you should be seeing the Language screen.

Roku TV | Language

Let's get started >

English
Deutsch
Español
Français
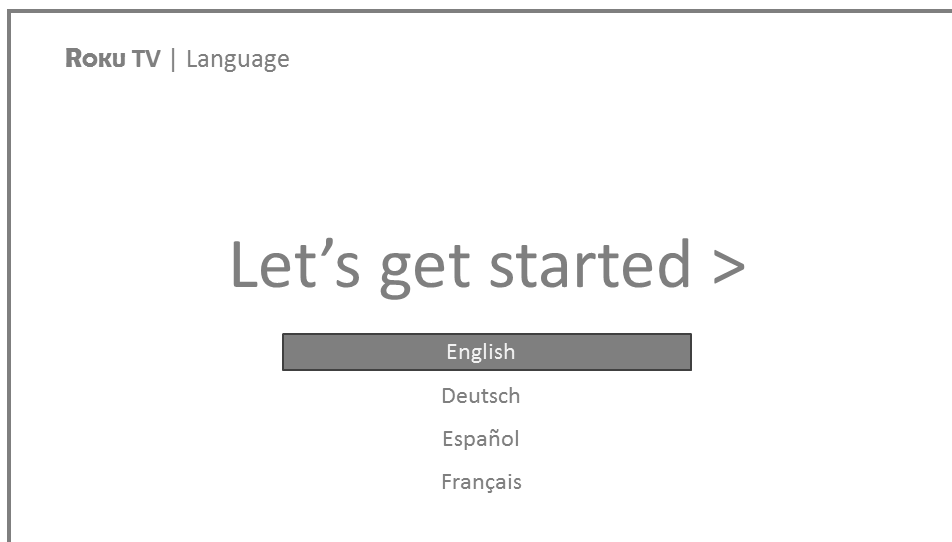
1. *Only on models that have a Roku voice remote*: A few moments after the Let's get started screen appears, Guided Setup starts the pairing process for the voice remote. (You'll know if you have this type of remote because it will have microphone or search button just below the down arrow on the purple pad.) If the voice remote does not pair automatically, follow the instructions on the screen to complete the pairing process.

   Tip: *On TVs sold in the United States, if you are blind or visually impaired, you can activate Audio Guide, a text-to-speech screen reader to help you navigate the TV's menus and commands. To enable the Audio Guide, press the ✱ button on the remote four times in rapid succession. Repeat to disable Audio Guide. (The ✱ button is located directly below the directional pad on the right side of the Roku remote.)*

   Note: *If you enabled Audio Guide, choosing any language other than English disables it.*

2. Press the DOWN arrow on the remote to highlight your preferred language, and then press OK or the RIGHT arrow.

3. *Some models have a country selection screen*: If you don't see this screen, skip ahead to the next step. If you see this screen, select your country.
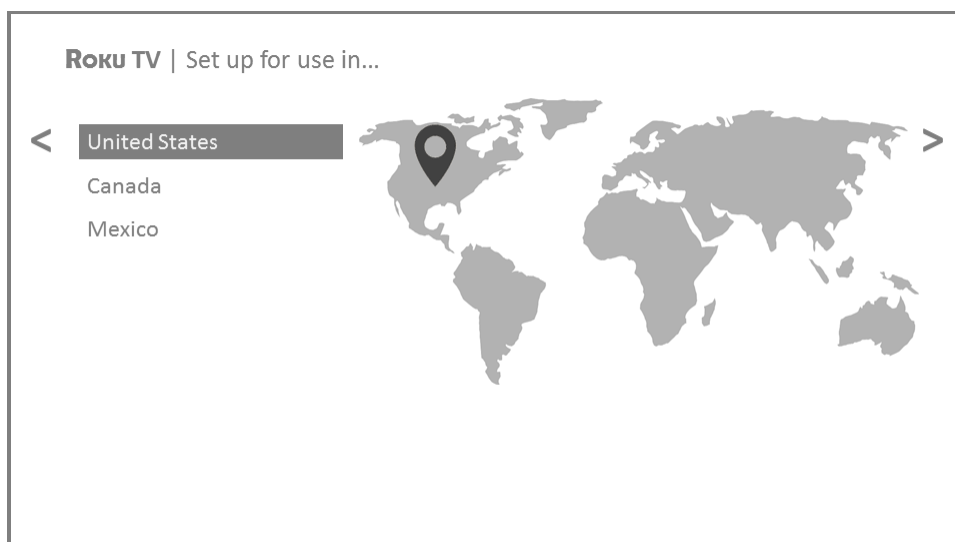
Note: *If you enabled Audio Guide, choosing any country other than United States disables it.*

4. Press OK or the RIGHT arrow on the remote to go to the next screen:
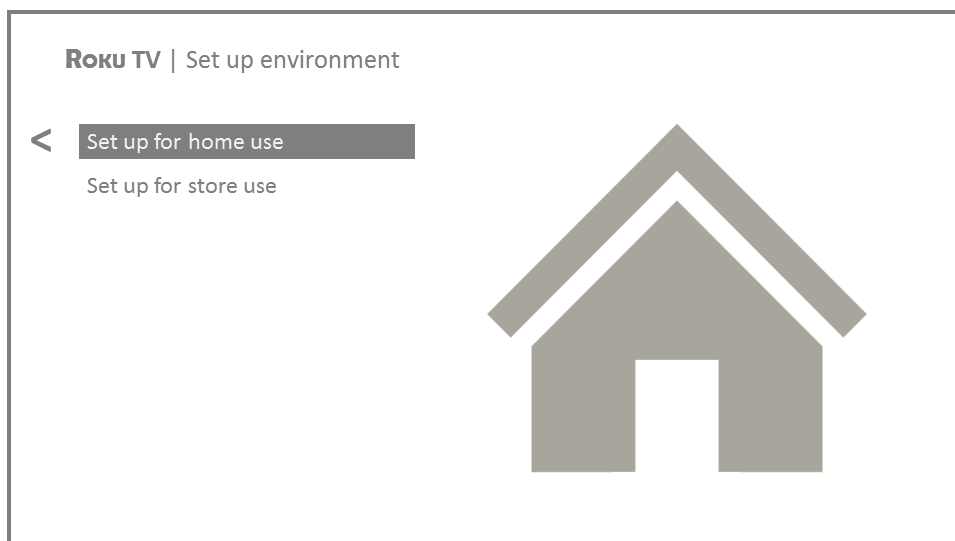
Note: *Some models show the title First things first instead of Set up environment.*

5. Press OK to select Set up for home use. This is the right choice for enjoying your TV at home. It provides energy saving options as well as access to all features of the TV.

Note: *Store mode configures the TV for retail display and is not recommended for any other use. In store mode, some features of the TV are missing or limited. To switch from one mode to the other, you have to perform a factory reset as explained in [Factory reset everything](), and then repeat Guided Setup.*

Network connection

After you select Set up for home use, the TV prompts you to make a network connection. If your TV has both wired and wireless connections, you'll see the following screen.
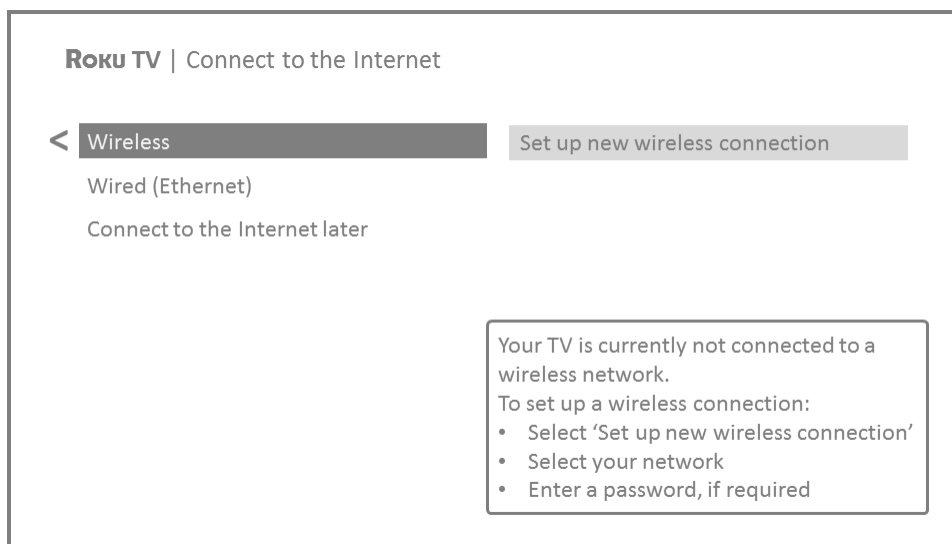
6. *Only models that display the Connect to the Internet screen:* Make a selection:

- Wireless connection – Highlight Set up new wireless connection and press OK. The TV prompts you through wireless setup. Skip ahead to the next step for help with the process.

- Wired connection – Highlight Connect to wired network and press OK. The TV immediately attempts to connect to your wired network, your local network, and then the Internet. Go to Step 9 to continue with Guided Setup.

- Connect to the Internet later – If you don't want to connect to the Internet right now, you can skip this step and use the TV to watch Antenna TV channels, play games, and watch DVDs. When you're ready to connect, it's easy. We'll show you how in [Benefits of connecting]().

Note: *If you decide not to connect, Guided Setup skips ahead to setting up the devices that you've connected to your TV. Jump ahead to* Connect your devices *to complete Guided Setup.*

7. *On models that have wireless only, or models with both wired and wireless and you've selected Wireless:* The TV scans for the wireless networks within range and displays them in order, with the strongest signals first. In addition to your own wireless signal, the TV might pick up signals from your neighbors.
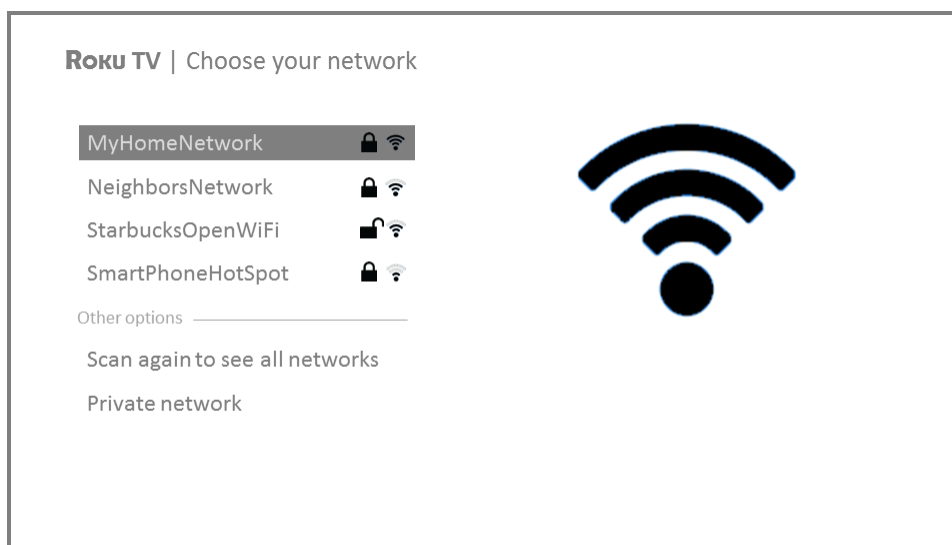
Press the UP or DOWN arrows to highlight the name of your wireless network, and then press OK to select it.

Note: *Some networks, such as those often found in dorm rooms, hotels, and other public places, require you to read and agree to terms, enter a code, or provide identifying information before letting you connect to the Internet. If your Roku TV detects that you are connecting to such a network, it prompts you through the connection process using your compatible smartphone or tablet to provide the needed information. For more information, see* Using your TV in a hotel or dorm room.

Other options

- Connect to the Internet later – If you don't want to connect to the Internet right now, you can skip this step and use the TV to watch Antenna TV channels, play games, and watch DVDs. When you're ready to connect, it's easy. We'll show you how in Benefits of connecting.

Note: *If you decide not to connect, Guided Setup skips ahead to setting up the devices that you've connected to your TV. Jump ahead to Connect your devices to continue.*

- Scan again / Scan again to see all networks – The name of this option depends on the number of wireless networks within range.

  o Scan again appears if the list already shows all available wireless networks within range. If you don't see your wireless network name in the list, you might need to adjust the location of your wireless router or the TV, turn on your router, or make other changes. When everything is ready, select Scan again to see if your network name now appears in the list.

  o Scan again to see all networks appears if there are more wireless networks than the strongest ones it initially listed. If you don't see your wireless network name in the list, this option displays the complete list. If you still don't see your network name, you might have your router configured to provide wireless service as a "private network."

  Note: *Highlighting either of these options displays an informational panel with the unique media access control (MAC) address of your Roku TV. You will need the MAC address if your wireless router is configured to use MAC address filtering.*

- Private network – If your wireless network name is hidden, it won't appear in the list. Select Private network to display an on-screen keyboard, and use it to enter your network name. Unless you changed the factory-set network name, you can find the name (also called SSID) on a label on the router.

  Tip: *Wireless networks that are password-protected display a "padlock" icon adjacent to the name. This icon enables you to know that you are going to be prompted to enter a password after you select that network.*
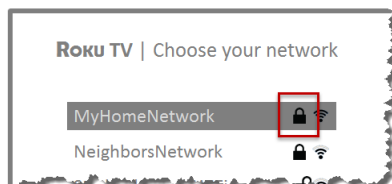
8. *Only if you select a password protected wireless network*: An on-screen keyboard appears. Use the keyboard to enter the network password.
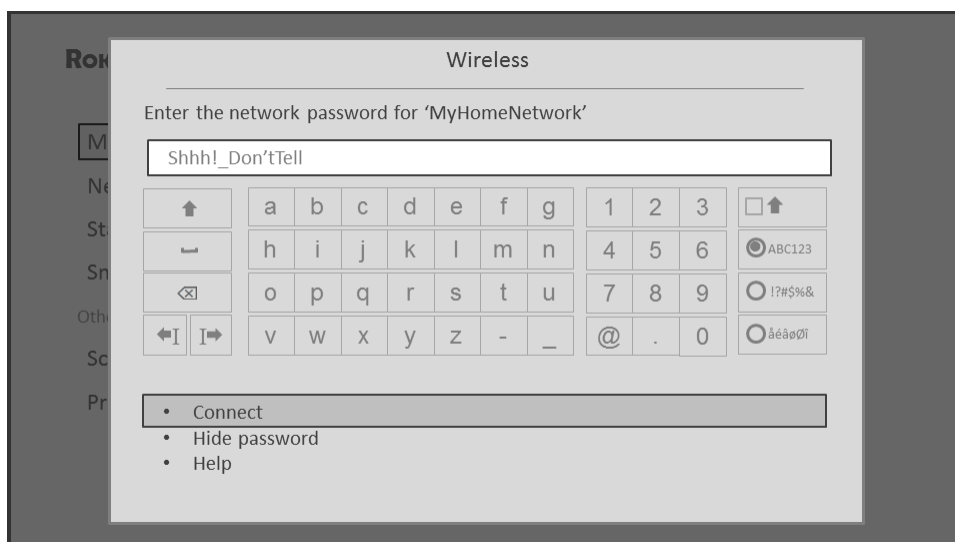
After you submit your wireless network password, the TV displays progress messages as it connects to your wireless network, your local network, and the Internet.

9. *Only if your TV cannot get the correct time zone and current time from your network service provider*: Use the UP and DOWN arrows to highlight your time zone, and then press OK.
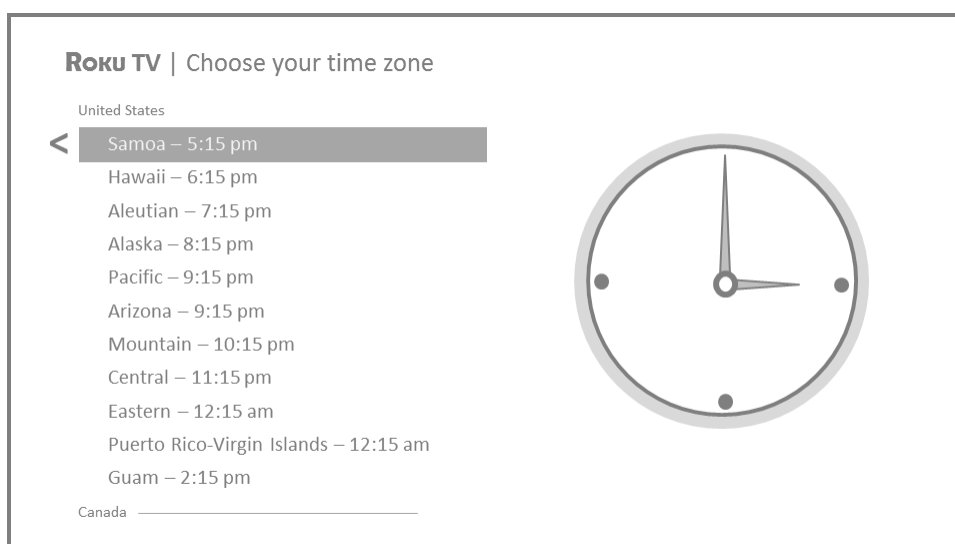
Tip: *Your TV needs to know the local time zone so that it can correctly display information about the program you are currently watching. If the TV is unable to*

automatically determine the local time zone, it prompts you to choose your time zone from a list.

As soon as the TV is able to connect to the Internet, it downloads and installs its first software update, and then restarts.

Tip: *Your TV automatically checks for updates periodically. These updates provide new features and improve your overall experience with the TV. After an update, you might notice that some Options have moved, and that there are new options or features. This User Guide describes version 8.0. To determine your current Roku TV software version, go to* Settings > System > About *after you complete Guided Setup. You can download an updated User Guide that matches your Roku TV software version from the Roku TV web site.*

Activation

After the TV restarts, it displays the Activation screen:
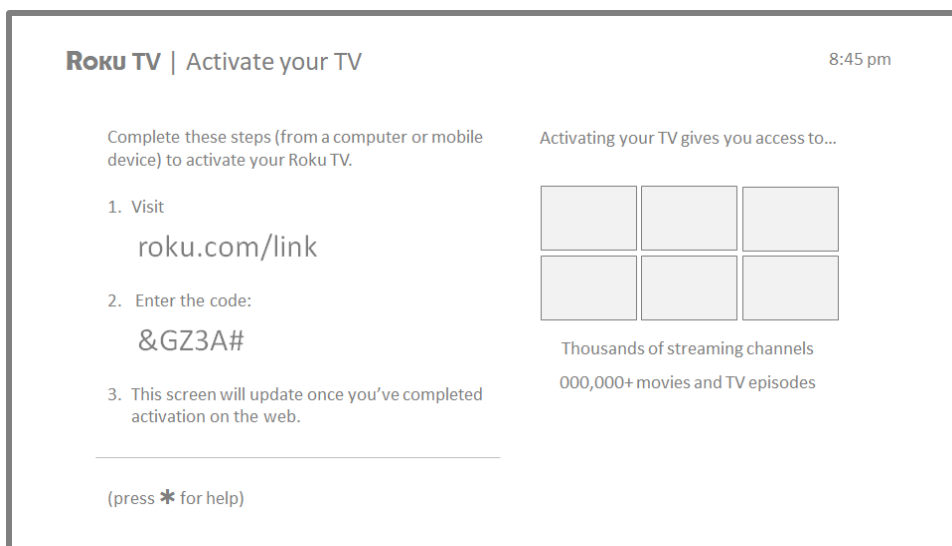
10. Using a compatible computer, tablet, or smartphone with an Internet connection, go to the web address displayed on the screen and enter the code that appears on your screen.

Why do I need a Roku account?

You need a Roku account for several reasons:

- It links you, your Roku TV, and your other Roku streaming devices to the Roku Channel Store and billing service.
- Streaming content providers know that it's OK to send content you request to your Roku TV.
- Roku can automatically send updates to your device.

You need a Roku account to activate your device and access entertainment across thousands of streaming channels. Roku accounts are free, and while a valid credit card number is not required to create your account, providing your credit card information makes renting and purchasing entertainment from the Roku Channel Store fast and convenient.

After you log in or create your Roku account, the link page suggests that you select some streaming channels. After you confirm your selections, the TV gets an acknowledgement, and then adds your preexisting and newly-selected streaming channels to your Roku TV. This process is automatic and takes a few moments—a little longer if you already have a lot of streaming channels to add.

Tip: *Streaming channels from all Roku streaming devices associated with your account are synchronized periodically, so that all of your Roku streaming devices have the same set of streaming channels (subject to compatibility with the device).*

Connect your devices

Next, Guided Setup helps you set up the external devices that you want to use with it, such as a cable box, Blu-ray™ player, or game console.
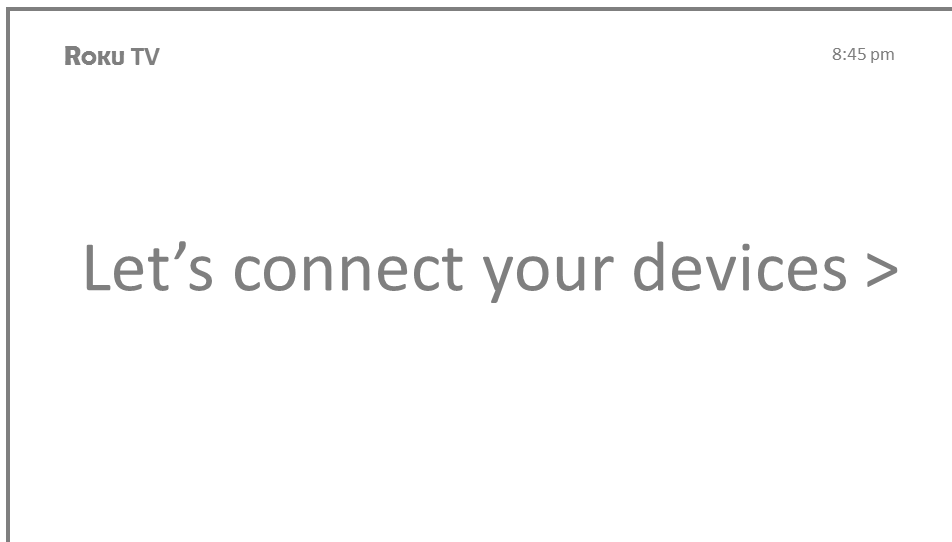
11. Press OK or the RIGHT arrow to proceed:

12. Connect all the devices you plan to use with your TV, turn them all on, and then select Everything is plugged in and turned on. The TV now takes you step by step through each of its inputs and asks what kind of device you have connected. On each input that has a connected and active device, you can see its picture and hear its sound.
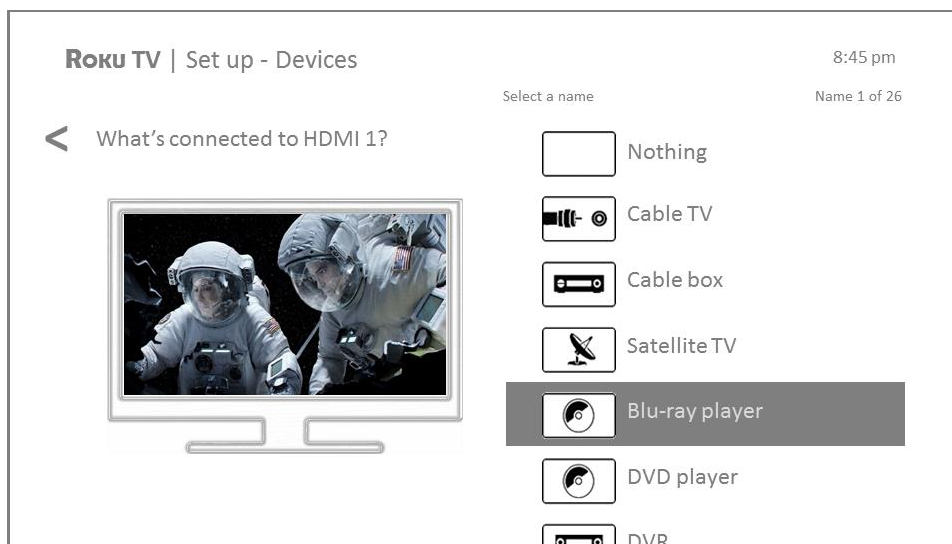
13. Press the UP or DOWN arrows to highlight the label you want to associate with the input. If you are not using the input, select Nothing, and the input won't appear on the Home screen.

14. While setting up your devices, rather than using the predefined names and icons, you can set a custom name and icon. To do so, scroll up or down to highlight Set custom name & icon, and then press OK. Follow the instructions on the screen to enter a name and select an icon for the input. See Rename inputs for more information.

Note: *If you have renamed the inputs, you cannot use voice commands to switch inputs. Voice commands can only switch among inputs that have their original names, such as "AV," and "HDMI 1."*

15. Repeat the previous step for each input.

You're done with Guided Setup.
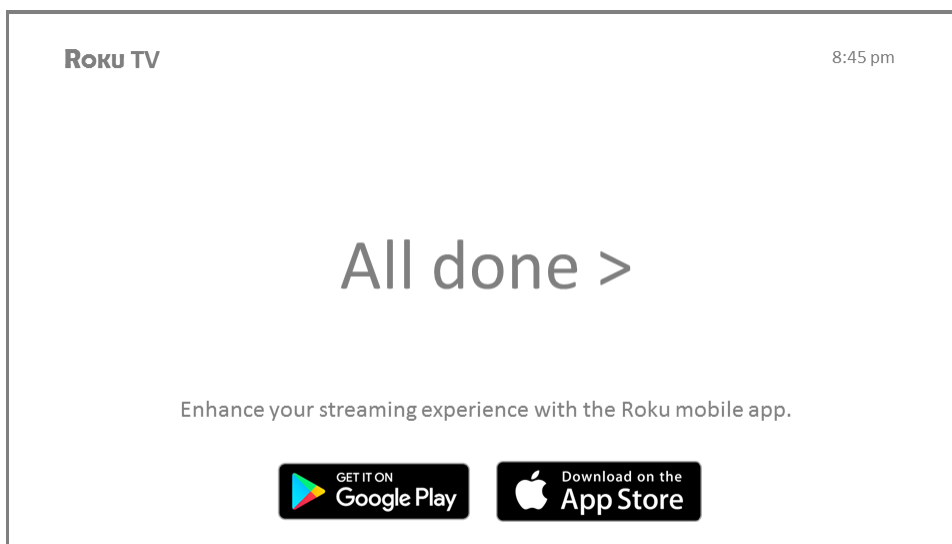
Note: *Some Roku TVs, depending on where you live and other factors, show you an introductory video filled with some great hints and tips. If you're not interested in viewing this video, press ⌂ on the remote to return to the Roku TV Home screen.*

Whenever you press ⌂ on the remote, the Home screen greets you.

From here, you can explore everything your TV has to offer. Press the arrow keys to move around, and press OK to select a highlighted item. We've designed the TV to encourage you to explore, and you can probably figure out most of the capabilities and settings on your own. If you have any questions or difficulties, you can find answers and solutions in this guide.

Home screen

The following illustrations show typical Home screens, which vary depending on location, connected mode, selected theme, number of TV inputs enabled, and streaming channels and apps added.

Note: *A paid subscription or other payments may be required for some channel content. Channel availability is subject to change and varies by country. Not all content is available in countries or regions where Roku® products are sold.*
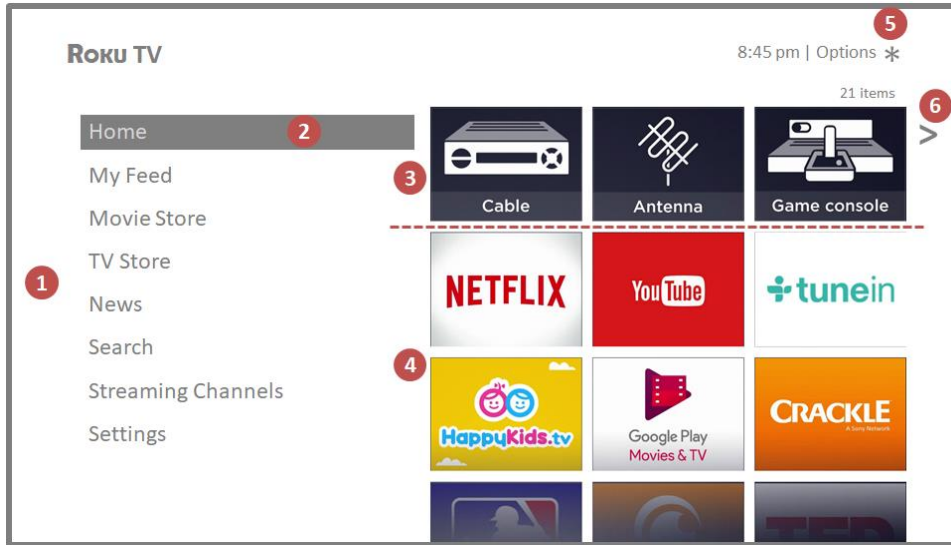
Typical connected Home screen, United States

1. Home screen menu—shows options available to you when you are on the Home screen.
2. Highlighted option—press OK on the remote to select.
3. TV input tiles—select an input to watch the connected device.
4. Streaming channel and app tiles—select a tile to go to the indicated streaming channel or application.
5. Options hint—press ✳ on the remote for options when this symbol is present.
6. Next screen hint—press the RIGHT arrow on the remote to see the next screen.
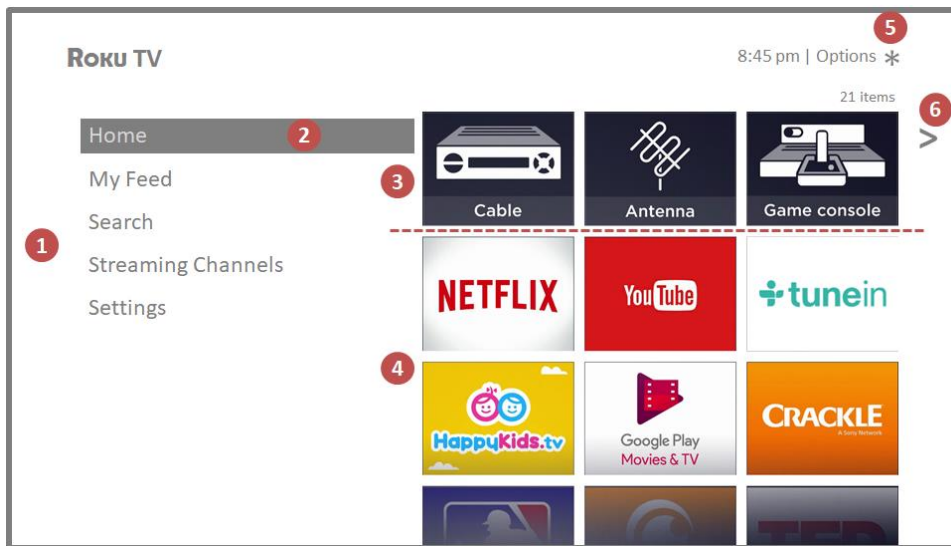
Typical connected Home screen, Canada

1. Home screen menu—shows options available to you when you are on the Home screen.
2. Highlighted option—press OK on the remote to select.
3. TV input tiles—select an input to watch the connected device.
4. Streaming channel and app tiles—select a tile to go to the indicated streaming channel or application.
5. Options hint—press ✳ on the remote for options when this symbol is present.

6. Next screen hint—press the RIGHT arrow on the remote to see the next screen.
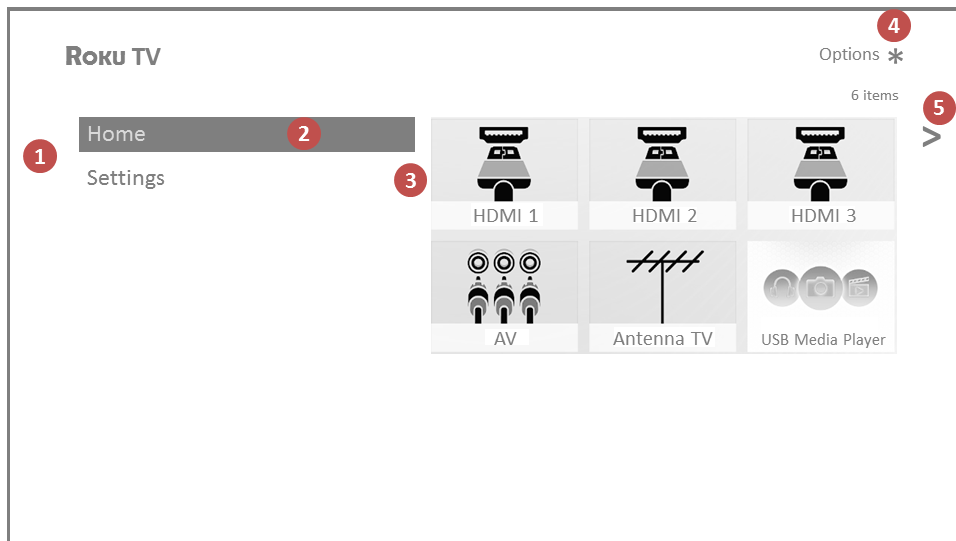
Typical non-connected Home screen

1. Home screen menu—shows options available to you when you are on the Home screen.
2. Highlighted option—press OK on the remote to select.
3. TV input tiles—select an input to watch the connected device.
4. Options hint—press ✷ on the remote for options when this symbol is present.
5. Next screen hint—press the RIGHT arrow on the remote to see the next screen.

Personalize your Home screen

There are many things you can do to personalize your Home screen and make it just right for you and your family:

- *Only in connected mode*: Add streaming channels by using the Streaming Channels menu option to browse the Roku Channel Store.

- *Only in connected mode*: Change the screen theme by going to Settings > Themes to find and pick one to suit your mood.

- *Only in connected mode on U.S. models*: Hide Movie Store, TV Store, or News as explained in Configure parental controls.

- Remove a tile by highlighting it and pressing ✷. Then highlight Remove input or Remove channel and press OK.

- Move a tile by highlighting it and pressing ✱. Then highlight Move input or Move channel and press OK. Use the arrows to move the tile, and then press OK to lock it in its new location.

- Rename a TV input tile by highlighting it and pressing ✱. Then highlight Rename input and press OK. Highlight a new name in the list, and then press OK to assign that name to the tile.

  Rather than using the predefined names and icons, you can set a custom name and icon. To do so, scroll up or down to highlight Set custom name & icon, and then press OK. Follow the instructions on the screen to enter a name and select an icon for the input.

  Note: *If you have renamed the inputs, you cannot use voice commands to switch inputs. Voice commands can only switch among inputs that have their original names, such as "AV," and "HDMI 1."*

Benefits of connecting

Connecting brings out your TV's full potential!

Make any night a movie night

Thousands of movies to choose from, across all major streaming movie channels like Netflix, Crackle, and more[*]. You'll never run out of something new to watch.

Get in the groove

Stream endless hours of music from free and subscription-based channels like Deezer and TuneIn. With almost instant access to thousands of music artists, your favorite beats are just as close as your remote.

Explore your passions

In addition to popular streaming channels like YouTube, NHL, Sky News and Google Play, your Roku TV also offers hundreds of streaming channels to fuel your passions—including fitness, cooking, religion, outdoors, International programming and much more.

Enjoy FREE trials of popular channels

Your Roku TV comes loaded with special offers, including free trials (if eligible) from popular streaming channels like Netflix, Hopster, Acorn TV, and many more. REMEMBER THAT YOU MUST CANCEL BEFORE THE FREE TRIAL ENDS TO AVOID SUBSCRIPTION FEES.

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[*] A paid subscription or other payments may be required for some channels. Channel availability is subject to change and varies by country. Not all content is available in countries or regions where Roku® products are sold.

Take advantage of awesome features

Powerful, voice-enabled search helps you find movies and TV shows, actors, or directors across multiple streaming channels. Search results also includes Antenna TV programs airing in your region as well. *Voice Search and Antenna TV search results are available only in the United States.*

Smart Guide is an electronic program guide that is available any time you are watching "over-the-air" TV programs on the Antenna TV input. You can scroll up and down to see all Antenna TV channels you receive. You can scroll left to see the previous 7 days programs, and scroll right to see the upcoming 14 days of programs. If you highlight a show that has a purple asterisk (✱), you can press the ✱ to see More Ways to Watch. And your most-watched channels are automatically grouped into a Favorites section at the top of the Smart Guide.

More Ways to Watch (U.S. only) gives you recommendations about the show you are watching on the Antenna TV, HDMI, or AV input, gives you options to stream the current show from the beginning, the entire season, or the entire series, and recommends other shows with similar themes. It also uses the shows you watch to display ads that are more relevant to you.

Live TV Pause lets you connect a USB drive (not provided) and pause live TV for up to 90 minutes. After pausing, you can play, fast-forward, rewind, and pause again to any point within the rolling 90 minute window.

Voice commands let you use your Roku Voice Remote, Roku Enhanced Voice Remote, or the Roku mobile app to change stations, TV inputs, and launch streaming channels, and more. *Voice commands are available only in the United States.*

Mobile Private Listening on the Roku mobile app lets you listen to streaming programs and "over-the-air" TV shows from the Antenna TV input on headphones (not provided) plugged into your IOS® or Android™ mobile device.

What is streaming?

Streaming is viewing or listening to video or audio content that is sent over the Internet, or located on a network-connected media server or on a USB device plugged into the TV's USB port.

With streaming, you can buy or rent most programs on demand, when it's convenient for you. When streaming, you can play, pause, rewind, and fast forward most of what you are watching. You can also replay the last few seconds again, or turn on closed captions.

Tip: *Some content cannot be paused or skipped. For example, if you are viewing live programming or a program that is supported by ads, you might not be allowed to skip the ads.*

Your Roku TV lets you choose from thousands of streaming channels that offer a huge selection of entertainment:

- Thousands of movies and TV episodes
- Unlimited music, live and on-demand
- Tons of live and on-demand sports
- Commercial-free kids programming
- International programming in 22 languages
- 24x7 news and in-depth news commentary

Many streaming channels are free. Some streaming channels, like Google Play, let you purchase or rent the latest movie releases or popular TV series. Some channels such as Netflix or Acorn TV charge a monthly subscription fee and others are available at no additional cost if you subscribe to a companion service through your cable or satellite provider.

If you have an existing subscription to a service like Netflix, you can just sign in with your existing user name and password.

To play streaming content, you add streaming channels to your Home screen. Use the Streaming Channels option on the Home screen menu to go to the Roku Channel Store, and then select the streaming channel you want to add. The channel remains on your Home screen unless you remove it, and you can watch it at any time.

For more information on using the Roku Channel Store feature, see Using the Roku Channel Store.

Note: *A paid subscription or other payments may be required for some channels. Channel availability is subject to change and varies by country. Not all content is available in countries or regions where Roku$^®$ products are sold.*

What if I didn't connect my TV?

What if you went through Guided Setup and chose Connect to the Internet later? No worries. Your Roku TV makes it easy to connect whenever you want. As you move around the Home screen, you'll see several places where you can start the connection process. For example:

- Now and then you'll see a message appear on the panel to the right of the Home screen offering a Connect Now option. Simply highlight and select the Connect Now option to get started.

- Use the Connect and activate now option in the Settings menu. From the Home screen menu, select Settings, then Network, and then Connect and activate now.

- If you want to start over from the beginning, use the Settings menu to do a Factory reset, and then go through Guided Setup again. This time, choose your home network when prompted.

Setting up Antenna TV

In addition to the other entertainment possibilities of your Roku TV, you may also want to watch broadcast channels from an antenna or cable TV service connected to the ANT input. On your Roku TV, you watch broadcast TV in much the same way you watch other entertainment choices. You select a tile—in this case, the Antenna TV tile—from the Home screen.

The first time you select the Antenna TV tile, you have to set up the TV tuner. Setting up the TV tuner scans for active channels and adds them to your Antenna TV channel list.

Why do I have to set up the TV tuner?

Not everyone needs to use the TV tuner. For example, you might have a set top box provided by a cable or satellite company that receives all of your channels. Most of these set top boxes use an HDMI® connection.

More and more people are watching only streaming TV and do not have a TV antenna or cable/satellite service. If you don't need the TV tuner, you can bypass setting it up and instead remove it from the Home screen as explained in Remove unwanted tiles.

When you set up Antenna TV, the TV scans the signals on its antenna input for channels with a good signal, and adds those to the channel list, skipping dead channels and channels with a very weak signal.

The TV lets you add two analog channels, even if they have no signal, for the purpose of using an older set top box, VCR, or game console that can only output a signal on analog channel 3 or 4. Typically, you'll only need one of these channels, but both are provided to make setup simpler. You can hide the one you don't want as explained in Edit Antenna TV channel lineup.

How do I set up the TV tuner?

1. Make sure your antenna (not provided) or TV cable is connected to the TV's ANT/CABLE input.

2. On the Home screen, select the Antenna TV tile.

3. Read the simple on-screen instructions, and then select Start finding channels.

4. If prompted, select your time zone. You'll only need to do this if the TV can't figure out your time zone from your Internet connection.
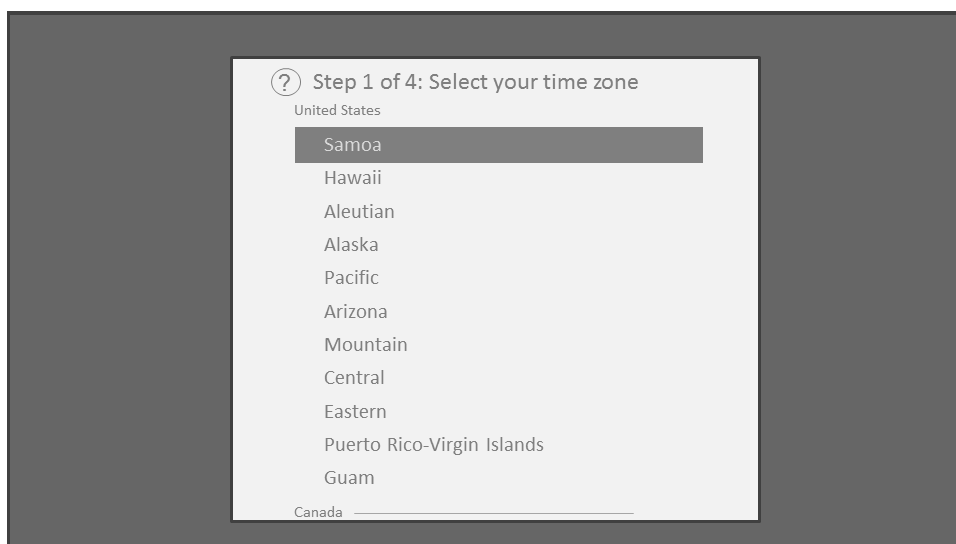
Why does the TV need my time zone?

The TV needs to know your time zone so that it can correctly display time information about the program you are currently watching.

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5. When prompted, select whether to add analog channels 3 and 4. These channels enable you to connect older set top boxes, VCRs, or game consoles.
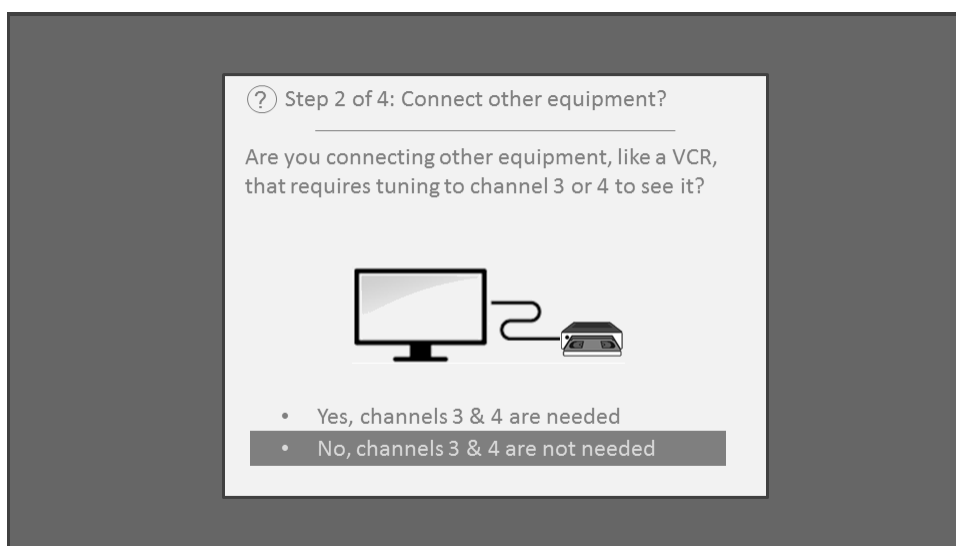
6. Wait while your TV scans for Antenna TV stations…
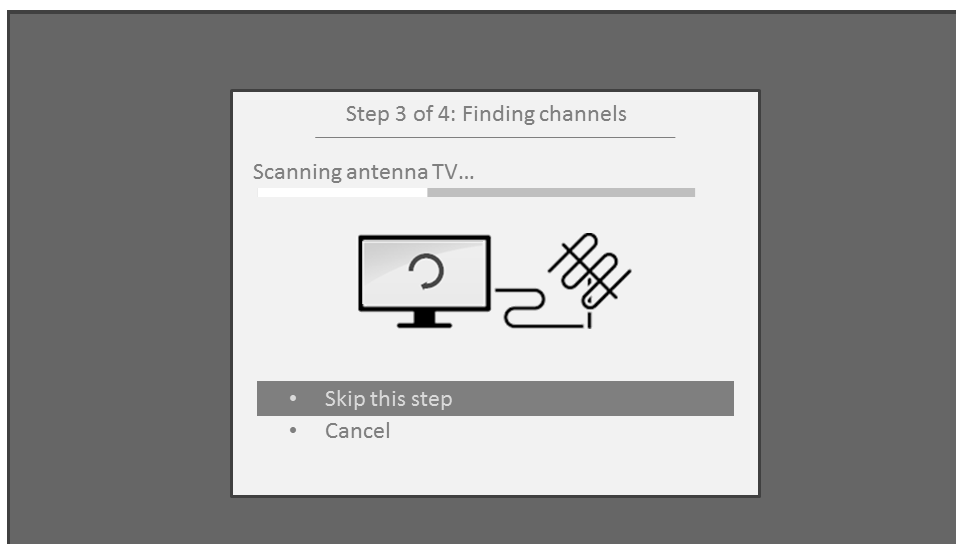
… and then cable TV channels.
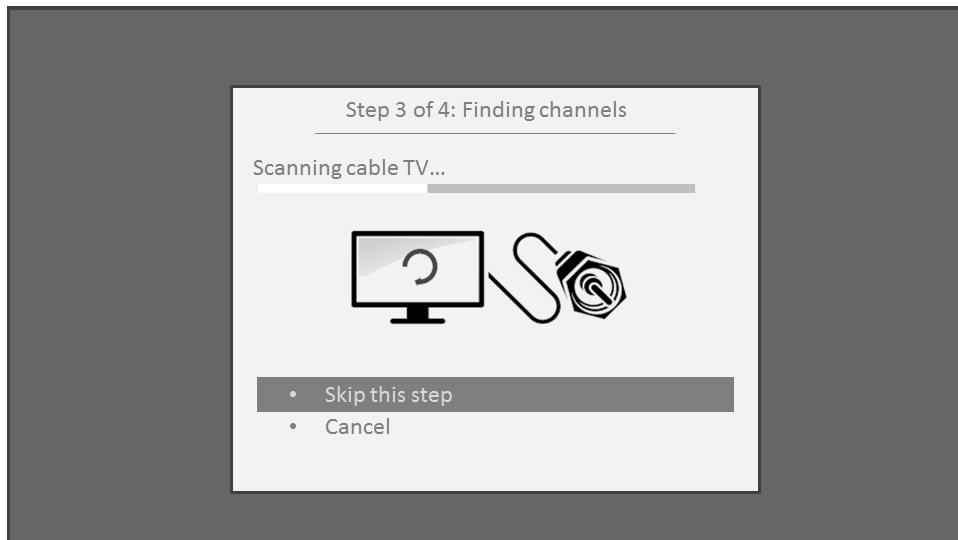
Scanning for channels can take several minutes.

Tip: *If you use a set-top box to receive cable TV channels (and don't have your cable connected directly to the TV's ANT input), you can save time by skipping the cable TV portion of the channel scan.*

7. When the channel scans finish, the TV shows the number of channels it added.
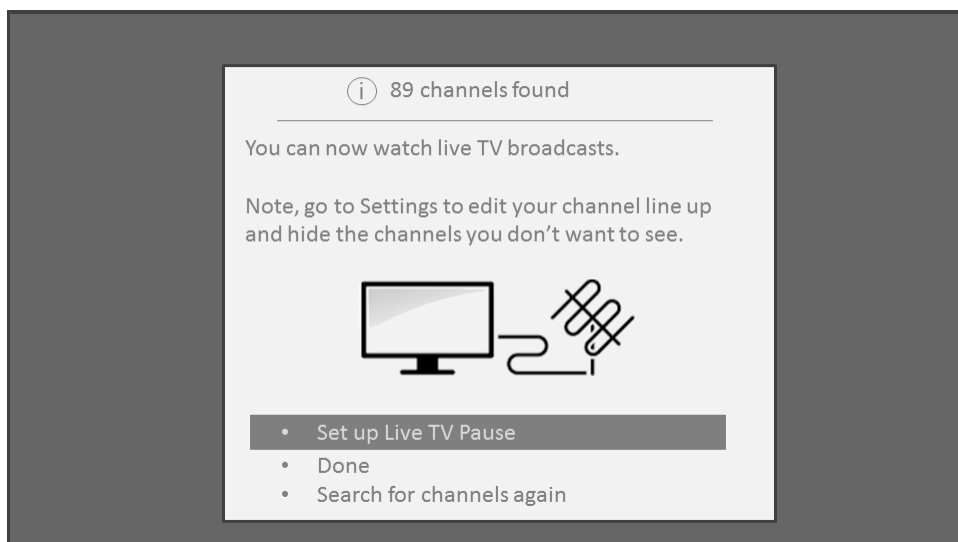
8. *Only in connected mode*, you have the option of setting up Live TV Pause. The topic Pausing Live TV explains how to set up and use this feature. If you don't want to set up

Live TV Pause, or if this option is not available to you, select Done to start watching Live TV.

Tip: *Repeat the channel scan from time to time to make sure you are receiving all of the latest channels. Broadcasters add and remove channels, move channels to different parts of the spectrum, and change the power levels of their channels periodically. Your antenna reception and picture quality depend on the position of your antenna and on your location relative to the antennas of broadcasters in your area.*

Note: *You'll have to repeat the channel scan if you remove and re-add the Antenna TV tile from the Home screen or perform a factory reset. To repeat the channel scan, go to Settings > TV inputs > Antenna TV > Scan again for channels > Start finding channels.*

Now, you're ready to watch Antenna TV! While you're watching, try the following tips:

- Press the UP and DOWN arrows to change channels.

- Press the LEFT arrow to display the channel list (non-connected mode) or Smart Guide (connected mode), and then use the UP and DOWN arrows to select a channel to watch. Or press REWIND or FAST FORWARD to jump through the channel list or Smart Guide a page at a time.

- Press OK to display information about the current program.

- Press ✱ to see options for picture and sound settings.

- *Only on models that have a Roku voice remote*, hold down 🎤 or 🔍, and then say the name of a movie, TV show, actor, or director. The TV displays the result and the streaming channels that offer the requested content. *Only in the United States*, the results also include shows on Antenna TV channels.

Note: *If you do not have a Roku voice remote, you can use the Roku mobile app to search. For more information, see [Getting and using the Roku mobile app](#).*

Using your TV

This section provides information on using the day-to-day features of your TV.

Status light

Your TV has a single status light on the front panel. It goes on and off and blinks in different ways depending on the status of the TV, as shown in the following table:

TV CONDITION	STATUS INDICATOR	MEANING
On (screen is active)	Off	Screen is communicating that TV is on.
Screensaver (screen is active)	Off	Screen is communicating that TV is on.
Off (no power)	Off	TV is not connected to power.
Off (standby)	On	TV is connected to power and is ready to use.
Starting up from off state	Slow pulsing blink until startup completes	TV is doing something.
On (receiving update from USB)	Slow pulsing blink until update completes	TV is doing something.
Remote command received	Dims on/off once	TV has received your command.
Network connection lost	Two short blinks, pause, repeat	TV was connected and paired with a Roku account and now has no network connection.
Powering down to standby mode	Slow pulsing blink until the TV reaches standby.	TV is doing something.

Standby mode energy savings

When you turn off your TV, it remains in a higher power mode for a few minutes, after which it goes into a very low power standby mode. If you turn on the TV again before it has entered the very low power mode, it turns on immediately. After the TV goes into the lower power standby mode, it takes a few seconds longer to start up.

Only in connected mode on TVs that do not have an Energy Star$^®$ rating, you can optionally enable Fast TV start. When this option is enabled, your TV starts up almost immediately regardless of how long it has been turned off, but uses somewhat more power in standby mode. For more information, see Fast TV start.

Opting in to Smart TV experience (U.S. only)

Only in connected mode in the United States, the first time you select Antenna TV, an HDMI input, or AV input, your TV offers to enable the Smart TV experience. If you decide to enable it at this time, you're all set to enjoy its recommendations and features.
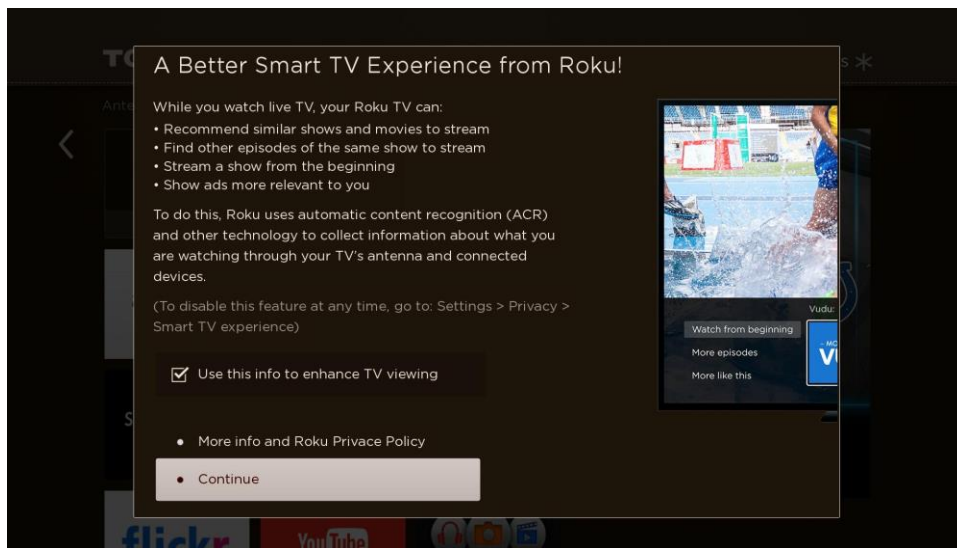
The Smart TV experience uses automatic content recognition (ACR) and other technology to collect information about what you watch through your Antenna TV, and on devices like media players and cable boxes connected to the HDMI or AV inputs. Opting in means that you give permission to analyze the programs you watch for the purpose of making recommendations, as well showing ads that are more relevant to you.

If you decide not to enable the Smart TV experience at this first opportunity, you can enable it later. Or, if you decide you'd rather not use the feature, you can disable it, but be aware that previously collected information is retained and not deleted.

Disable Smart TV experience

If you decide you want to disable Smart TV experience, follow these steps:

1. From the Home screen, go to Settings > Privacy > Smart TV experience.

2. Navigate to the right to highlight Use info from TV inputs.

3. Press OK on the remote to clear the check box.

Disable Auto Notifications

If you want to keep the Smart TV experience enabled, but you do not want to see notifications while you are watching shows, you can disable notifications. To do so, follow these steps:

1. From the Home screen, go to Settings > Privacy > Smart TV experience.

2. Navigate to the right to highlight Use info from TV inputs.

3. Press DOWN on the remote to highlight Enable auto notifications.

4. Press OK on the remote to clear the check box.

Note: *These settings do not affect recommendations for More Ways to Watch that you see in the Smart Guide when watching Antenna TV channels. Those recommendations come from the Smart Guide and do not rely on ACR technology.*

Watching Antenna TV channels

Select the Antenna TV tile in the Home screen. Your TV remembers the last channel you watched and starts with that channel playing.

Changing channels

To change channels, you can do any of the following:

- Press the UP arrow to change to the next higher channel.

- Press the DOWN arrow to change to the next lower channel.

- Press the LEFT arrow to display the channel list (in non-connected mode) or Smart Guide (in connected mode), and then press the arrow keys to select the channel or show you want to watch. Press REWIND and FAST FORWARD to move through the list one page at a time. When you've highlighted the channel or show you want to watch, press OK. (If you decide you don't want to change channels, press the BACK button).

- *Only if Live TV Pause is not enabled*, press ↻ to jump to the previous channel. Press again to return to the channel you were watching before you pressed ↻.

Note: *If the ↻ button is not available on your remote, you can use this feature in the Roku mobile app. For more information, see Getting and using the Roku mobile app.*

Favorite Channels in non-connected mode

You can quickly change from surfing among all channels or only your favorite channels. First, you have to mark one or more channels as your favorites.

Note: *In the United States, in connected mode, favorite channels appear at the top of the Smart Guide automatically after several days of watching Antenna TV channels. For details, see [Smart Guide](#).*

Mark your favorite channels

In non-connected mode, you can make any channel a favorite whenever you're watching Antenna TV channels.

1. Press the LEFT arrow to display the channel list. Notice that the words All channels appear at the top of the channel list.

2. Scroll up or down to highlight a channel that you want to make a favorite.

3. Press ✱. At this point, you'll see two options:
   - Add to favorites
   - Back

4. With Add to favorites highlighted, press OK. A ♡ symbol appears adjacent to the channel to indicate that it is now a favorite.

5. Repeat these steps to add more favorite channels.

Surf only your favorite channels

In non-connected mode, after you've marked one or more channels as favorites, you can switch to your favorite channels whenever you're watching Antenna TV channels.

1. Press the LEFT arrow to display the channel list.

2. Press the LEFT or RIGHT arrow once to switch to Favorites. Notice that the word Favorites appears at the top of the channel list.

3. Highlight a channel and press OK to select one of the channels in the Favorites channel list, or wait a few moments until the channel list disappears.

4. Press the UP or DOWN arrow to change to the previous or next favorite channel. Each channel you select in this way is a favorite channel. Your channel surfing is limited to favorite channels only.

Your favorite channel list remains in effect even if you turn off or unplug your TV, until you switch back to all channels.

Note that when you press OK to view the program information banner while watching a show, a ♡ symbol appears below the channel number.

Surf all channels again

In non-connected mode, you can switch back to all channels whenever you're watching Antenna TV channels.

1. Press the LEFT arrow to display the channel list.

2. Press the LEFT or RIGHT arrow once to switch to All channels. Notice that the words All channels appear at the top of the channel list.

3. Highlight a channel and press OK to select one of the channels in the All channels list, or wait a few moments until the channel list disappears.

4. Press the UP or DOWN arrow to change to the previous or next channel among all your available channels. You can surf among all channels in your channel list.

Remove a channel from your favorites

In non-connected mode, you can remove a channel from your favorites whenever you're watching the Antenna TV input.

1. Press the LEFT arrow to display either channel list—All channels or Favorites.

2. Scroll up or down to highlight a favorite channel that you want to remove from your favorites.

3. Press ✳ on your remote. At this point, you'll see two options:
   - Remove from favorites
   - Back

4. With Remove from favorites highlighted, press OK. The ♡ symbol adjacent to the channel disappears.

5. Repeat these steps to remove other channels from Favorites.

Smart Guide (U.S. only)

Only in connected mode in the United States, use the Smart Guide to find over-the-air TV shows through the Antenna TV input. The Smart Guide lets you scroll through all TV channels (except those you have hidden, if any). You can see all the shows from today, the previous 7 days, and the upcoming 14 days.

The ability to see shows that have already aired during the previous week enables you to use More Ways to Watch to catch up on missed movies or episodes by selecting them from one of the streaming channels. Your clue that there are More Ways to Watch a show is a purple asterisk (✳) next to the program name in the guide.

For example, you might turn on your TV at 10 minutes past the hour and discover you are missing the current episode of *Empire*. But, there is a purple asterisk next to the show title, so you can press ✳ and find that there are several streaming channels where you can watch the current episode from the beginning. You also can find more episodes of *Empire*, and other shows that have a similar theme.

Note: *A paid subscription or other payments may be required for some channels.*

To view the Smart Guide, press the LEFT arrow. The Smart Guide opens showing the name of the current program highlighted, and a lot more information.
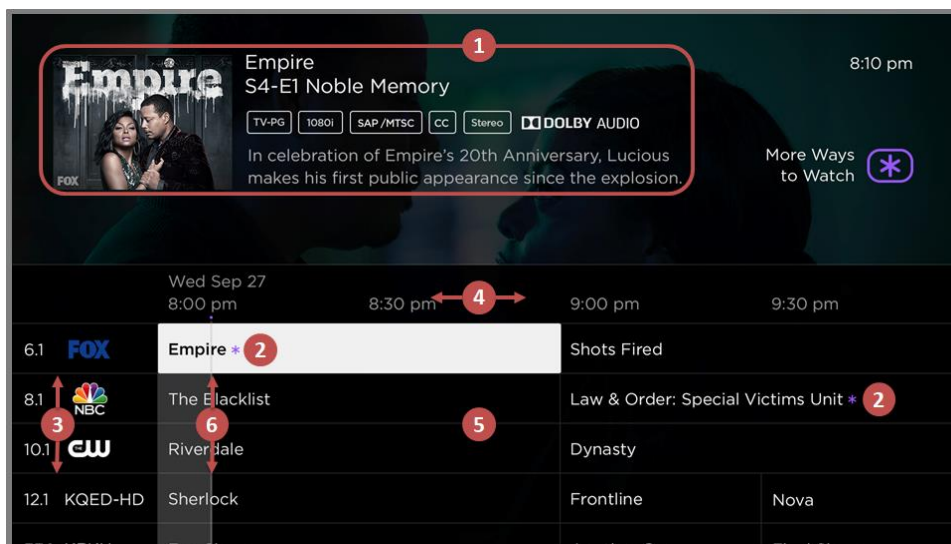
1. Program information for the highlighted show. See Viewing program information for details.
2. More Ways to Watch indicator. See More Ways to Watch for more information.
3. Channel list. Navigate with the UP and DOWN arrows.
4. Time slots. Navigate with the LEFT and RIGHT arrows. Use the FF and REW buttons to skip ahead or back 24 hours.
5. Program list
6. Progress bar showing the approximate time with respect to the time slots.

As you navigate, notice that the Smart Guide shows a light gray background for programs and portions of programs that have already aired. It shows a black background for programs and portions of programs that have not yet aired. The line dividing these two zones is the progress bar.

Navigating the Smart Guide

- To switch to a program that is currently in progress, highlight it, and then press OK.
- To return to the current time after navigating to a different time slot, press REPLAY ↻.
- To return to the currently airing program without causing a channel change, press BACK.
- To see More Ways to Watch, highlight any show that has a purple asterisk (✱), and then press ✱.

Favorite channels in the Smart Guide

The Smart Guide organizes your favorite channels at the top of the program list for convenient access. It does this automatically as you use your TV over several days. If you would prefer not to have a favorites section in the Smart Guide, you can turn this feature off.

Turn off favorite channels

1. From the Home screen menu, navigate to Settings > TV inputs > Antenna TV > Favorite channels.

2. Highlight Enable 'Favorite channels'.

3. Press OK to clear the check mark.

Viewing program information

You can view program information in different ways:

- *Only in connected mode in the United States*, view program information for any program listed in the Smart Guide. Press the LEFT arrow while watching Antenna TV to see the Smart Guide. For more information, see Smart Guide.

- View program information for the current program in a banner at the bottom of the screen. You can view program information in this way on both connected and non-connected TVs. The following illustration shows the information that is available:

Program information banner

Program information might include any or all of the following, depending on availability within the broadcast information:

- Channel number
- Channel call sign
- Favorite channel icon ♡
- Signal strength
- Program title and episode name/number
- Start time, end time, and graph of program length showing current position
- Content rating
- Video resolution (480i, 480p, 720p, 1080i, 1080p, 4K)
- Frame rate (24Hz, 30Hz, 60Hz for television sources, 60Hz, 70Hz, 72Hz, 75Hz for computer sources)
- Audio format (Mono, Stereo, Dolby Audio™ logo)
- Audio features (SAP/MTS)
- Only on select 4K models: HDR or Dolby Vision™* logo (HDMI® and streaming sources)
- Closed captioning (CC)
- Current time
- Program description. If the entire description does not fit, press OK to expand the size of the banner and see the entire description.

Tip: *If you've set up Live TV Pause and you're watching Antenna TV, you'll also see a progress bar showing the current playback position within the rolling 90-minute pause time. For more information, see [Pausing Live TV](#).*

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* The Dolby Vision™ logo appears only on Dolby Vision™-certified models when displaying Dolby Vision™ content.

Adjusting settings while watching a show

Press ✱ to display the Options menu (except when you are viewing the program information banner). Press the UP and DOWN arrows to highlight an option, and then press the LEFT and RIGHT arrows to change the setting. The topic [Adjusting TV settings](#) explains each of the settings in detail.

Pausing Live TV

Live TV Pause gives your Roku TV the ability to pause, play, fast forward, and rewind digital Antenna TV. You can pause Antenna TV for up to 90 minutes.

Requirements

To use this feature, you need to:

1. Connect your TV to the Internet. If you didn't connect during Guided Setup, see [What if I didn't connect my TV?](#).

2. Provide your own dedicated USB drive with the following minimum specifications.
    - 16 GB
    - 15 Mbps read/write speed
    - USB 2.0 compliant

    A USB flash drive (thumb drive) meeting the minimum requirements is highly recommended. Note that using a larger drive does not extend the 90 minute pause time.

    Important: *All existing content on your USB drive is erased when you enable this feature.*

3. Connect your USB drive to the TV's USB port.

    Important: *Some TV models have more than one USB port. You can connect your Live TV Pause USB drive to any port, but make sure that nothing is connected to other USB ports while enabling Live TV Pause. Reconnect other USB devices after you have finished enabling Live TV Pause.*

4. Enable Live TV Pause, as explained in the following topic.

Enabling Live TV Pause

You can start setting up Live TV Pause in any of the following ways:

- Go to Settings > TV inputs > Antenna TV > Live TV Pause, and then select Enable.

- After completing a channel scan, select Set up Live TV Pause from the available options.

- Press Play/Pause on the Roku remote while watching a digital Antenna TV channel.

- Highlight the Antenna TV tile on the Home screen, press ✻ on the remote, and then select Enable Live TV Pause.

After starting setup of Live TV Pause in any of these ways, the TV prompts you through the steps needed to enable this feature. Setup takes only a few moments.

Note: *Use of a USB hub is not supported.*

Using Live TV Pause

If you have used the Roku remote to watch streaming channels, using Live TV Pause should be very familiar to you.

- While watching a digital Antenna TV channel, press PLAY/PAUSE to pause or play the content. After the TV program has been paused for 90 minutes, the TV resumes playing.

- After watching a channel for a while, press REWIND to jump back up to the point where you first started watching the channel, up to 90 minutes.

- After pausing or rewinding, press FAST FORWARD to jump ahead up to the point where you are once again watching the live TV program.

- Press FAST FORWARD or REWIND repeatedly to cycle through 1x, 2x, and 3x skip speeds. Press INSTANT REPLAY ↺ to play back the last several seconds of the program.

- When the program is paused, press the LEFT and RIGHT arrows to move forward and backward through the program approximately 10 seconds per press. Small frames appear across the screen to identify your location in the program.

Note: *If the ↺ button is not available on your remote, you can use the Roku mobile app. For more information, see [Getting and using the Roku mobile app](#).*

Whenever you use any of the Live TV Pause features, the TV momentarily displays a progress bar:
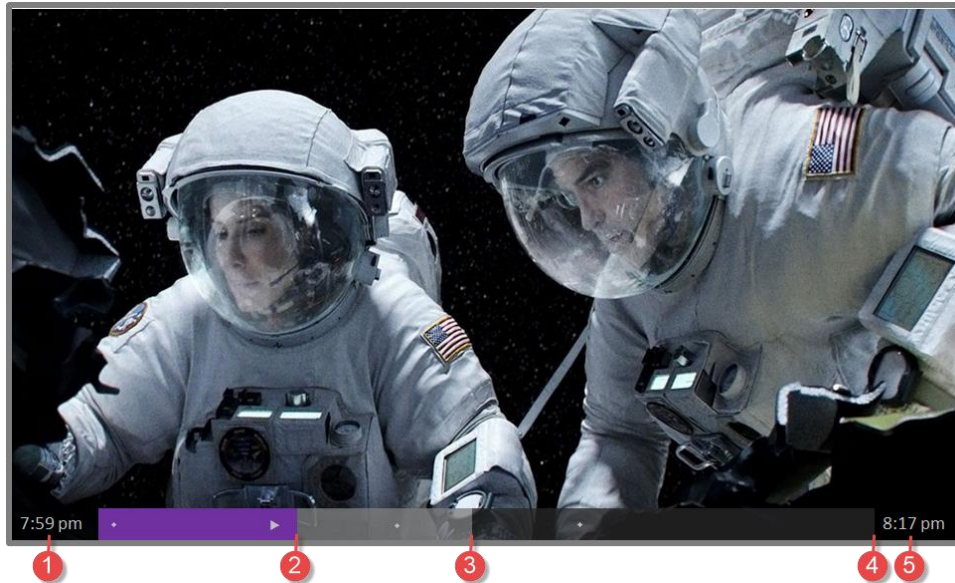
1. Time at current playback position.
2. Current playback position
3. Extent of pause time, representing the amount of time this channel has been buffered, up to 90 minutes.
4. 90 minute mark, representing the maximum extent of pause time.
5. Current time.

The progress bar also displays tick marks at each half hour point, to help you locate the boundaries where one show ends and a new one begins.

Notes about Live TV Pause

- You can use Live TV Pause only with digital broadcast and cable channels received through the TV's ANT input (ATSC and Clear QAM channels).

- Changing channels erases and restarts the Live TV Pause buffer.

- Returning to the Home screen, selecting another input, or turning off the TV erases and resets the Live TV Pause buffer.

- Removing the USB drive erases the Live TV Pause buffer.

More Ways to Watch (U.S. only)

Only in connected mode in the United States, More Ways to Watch gives you recommendations about the shows you're watching on the Antenna TV, HDMI, or AV input. You will automatically get these recommendations in the Smart Guide and in the program information banner for Antenna TV programs. However, before you can get recommendations for shows you're watching through the HDMI or AV inputs, you must opt into the Smart TV experience to acknowledge that you want to allow the TV to use automatic content recognition (ACR). See Opting in to Smart TV experience for details.

Not every show provides recommendations. For details about what you'll see when a recommendation appears, see Using More Ways to Watch.

Using More Ways to Watch

As you use More Ways to Watch, be aware that you'll only see suggestions on your TV when all of the following conditions are met:

- Your TV is operating in connected mode in the United States.

- If you are watching shows through and HDMI or AV input, you've enabled Smart TV experience. (If you are watching Antenna TV channels, this setting does not matter.)

- The program you're watching contains the information needed to identify it. Note that some programs, such as the daily news, typically do not activate More Ways to Watch.

- At least one participating streaming channel offers the movie or TV show you are watching, or other episodes, or more shows like the one you are watching.

If all of these conditions are met, you can view the suggestions. More Ways to Watch recommendations appear in several places:

- When watching the HDMI and AV inputs, you'll see a More Ways to Watch notification in the lower right corner of the screen for a few seconds unless you have disabled Enable auto notifications:
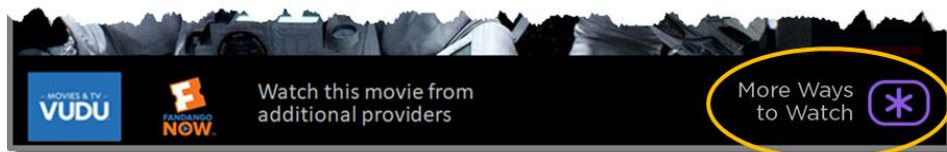
Note: *After this banner disappears, you can restore the More Ways to Watch prompt by pressing OK.*

- For shows on Antenna TV channels, check the program information banner that appears for a few moments when you change channels or when you press OK while watching a show. If your TV has suggestions, you'll see a More Ways to Watch notification in the banner:
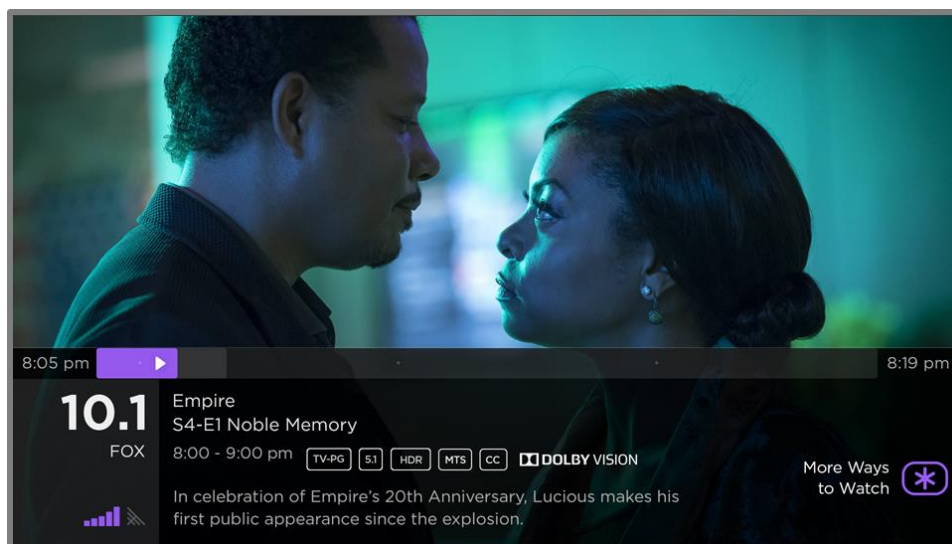
- In the Smart Guide, you can view More Ways to Watch recommendations on any program that shows a purple asterisk ✱ next to its title:
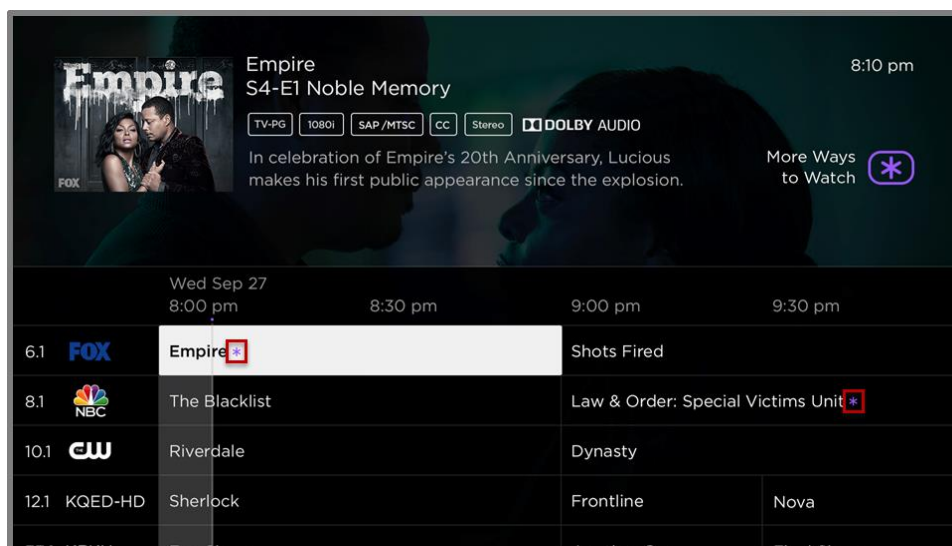
Regardless of which More Ways to Watch prompt appears, press ✱ to see the recommendations. The options you'll see depend on the type of show you're watching and the available ways there are to watch, so you might see any or all of the following:
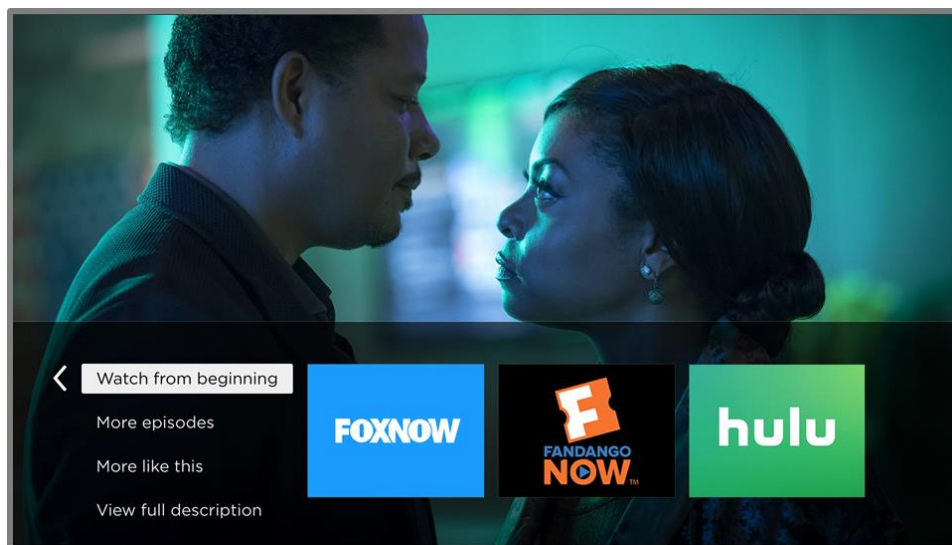
- Watch from beginning – Streaming channels on which the same TV show or movie is available. Generally, this option does not appear on first run programs, because streaming content is not available until a later date.

- More episodes – Streaming channels where you can find other episodes of the TV show you are watching. Does not apply to movies.

- More like this –TV shows or movies with a similar theme.

- View full description – Full description of the selected show.

Press the DOWN arrow to select an option, and then press the RIGHT arrow to select the channel you want to use to watch from the beginning or watch more episodes, or the other TV show or movie with a similar theme.

Assuming you've already added the channel and completed any required sign-in, More Ways to Watch takes you directly to the program in the streaming channel where you can select and watch the program. Otherwise, it prompts you to add the channel and, if you do, then takes you to the show.

Getting the most from More Ways to Watch

- Streaming channels you've already installed appear first in the list of suggestions.

- When you select a streaming channel, you leave the program you are currently watching.

- If you've used the Live TV Pause feature to pause the program, your paused program buffer is deleted. In other words, you cannot return to an Antenna TV channel and resume watching where you left off.

Switching TV inputs

Switch TV inputs to access the device connected to that input, for example, a Blu-ray™ player. Switching inputs is as simple as highlighting the input's tile in the Home screen, and pressing OK. The video signal on the input, if any, plays on the screen.

Tip: *To learn how to add, remove, rename, and rearrange the tiles on your Home screen, see* [Customizing your TV]().

Auto-detecting devices

Your TV automatically detects when you connect a new device to an HDMI® input and turn on its power. The input is automatically added to the Home screen if it isn't already present.

Adjusting audio/video settings

While watching video content on any input, press ✱ to display the Options menu. Press the UP and DOWN arrows to highlight an option, and then press the LEFT and RIGHT arrows to change the setting. To learn about each of the audio and video settings, see [Adjusting TV settings]().

Playing content from USB storage devices

Only in connected mode, your Home screen has the Roku Media Player tile. Otherwise, the Home screen has the USB Media Player tile. You can play personal music, video, and photo files from a personal USB flash drive or hard disk connected to the TV's USB port.

To use this feature, make sure your media files are compatible with the Roku/USB Media Player. To see the latest list of supported formats, view Help in the Media Player[*]. The Roku/USB Media Player displays supported file types only, and hides file types it knows it cannot play.

For more information about playing back your personal videos, music, and photos, go to the following link on the Roku web site:

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[*]   There are many variants of each supported media format. Some variants may not play at all or may have issues or inconsistencies during playback.

go.roku.com/rokumediaplayer

Auto player launch

Only in connected mode, you can set your TV to automatically open the Roku Media Player when you connect a USB drive with a recognizable file system (such as FAT16/32, NTFS, HFS+ or EXT2/3). To configure this setting, from the Home screen, navigate to Settings > System > USB media. At this point, the following options are available:

- Auto-launch – Choose Prompt, On, or Off, as desired.

  o Prompt – (default) Display a prompt each time a recognized USB drive is connected. The prompt provides options to launch the Roku Media Player as well as to change future auto-play behavior.

  o On – Always launch the Roku Media Player whenever you connect a recognized USB drive.

  o Off – Never launch the Roku Media Player automatically.

- Launch channel – Choose the app you want to use to play back media files.

Playing content from local network media servers

Only in connected mode, your TV can play personal video, music, and photo files from a media server on your local network. Media servers include personal computers running media server software such as Plex or Windows Media Player, network file storage systems that have built-in media server software, and other devices that implement the specifications of the Digital Living Network Alliance. Some servers do not fully implement the DLNA specification but are UPNP (Universal Plug and Play) compatible. The Roku Media Player will connect to them as well.

Some media servers can convert files into Roku compatible formats. DRM-protected content is not supported.

Using your TV in a hotel or dorm room

Hotels, school dorms, conference facilities, and similar locations with public wireless Internet access often require you to interact with a web page to authenticate your access. These types or networks are called *restricted public networks* . When you select a network of this type, the TV automatically detects that additional information is needed and prompts you through using another wireless device to supply the requested information.

About using your TV on a restricted public network

Here are some points to keep in mind when using your TV on a restricted public network:

- Using your Roku TV on a hotel or dorm room network requires wireless availability and a network-connected smartphone, tablet, or computer to authenticate access to your wireless access point.

- You will need your Roku TV remote.

- Some content might be limited or unavailable if you try to connect outside your home country due to geo-filtering.

Getting your Roku TV on line on a restricted public network

1. Either during Guided Setup or after using the Settings > Network menu to set up a new connection, the TV automatically detects that you are connecting to a restricted network and displays the following prompt:
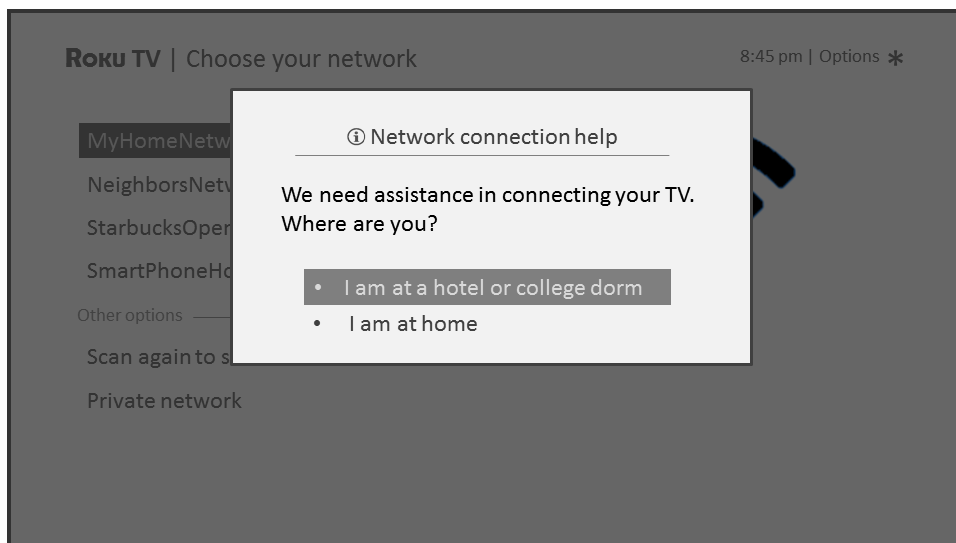
Tip: *Your TV can connect to a restricted network only if Enable 'Device connect' is selected in Settings > System > Advanced system settings. (Device connect is enabled by default, but if you have disabled it, the TV cannot complete the connection.)*

Note: *Device connect is not present if the TV is in non-connected mode.*

2. After selecting the correct network, highlight I am at a hotel or college dorm, and then press OK. The TV prompts you to use your smartphone, tablet, or laptop to complete the connection.
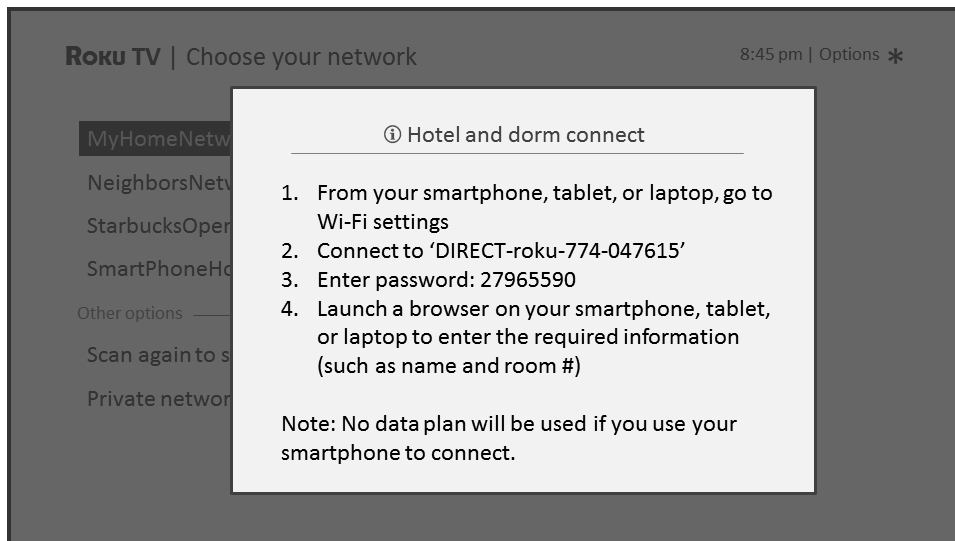
3. Use a phone, tablet, or wireless-enabled computer to detect wireless networks. In most cases, you can simply open the device's Wi-Fi Settings or Network Settings screen to start scanning.

    Note: *The phone, tablet, or computer must be on the same wireless network to which you are connecting the TV.*

4. Connect to the network named on your TV screen. The actual network name varies.

    Note: *The previous step connects your smartphone, tablet, or computer directly to the TV. No connection charges apply and the connection does not impact your device's data plan.*

5. The wireless connection process prompts you for a password. Enter the password as shown on the TV screen. The actual password varies.

6. Start the web browser on your smartphone, tablet, or computer. When you attempt to open any web page, the restricted connection will prompt you for whatever information it needs. In most cases, you must agree to terms and conditions, provide identifying information, or enter a password, PIN, or room number to proceed. The information requested depends on the organization that controls the wireless connection.

7. After you enter the requested information, the TV automatically proceeds to complete its connection and resumes normal operation.

8. If the TV prompts you to link to your Roku account, use your smartphone, tablet, or computer to complete the pairing operation and activate your Roku TV.

Roku voice remotes (select models only)

Only on TVs with the Roku voice remotes: The following topics explain how to get the most out of your TV when it includes a Roku Voice Remote or Roku Enhanced Voice Remote.

Re-pairing your Roku voice remote

The Roku voice remotes operate with wireless radio-frequency signals and must be paired with your TV. You initially paired the remote when you set up your TV during Guided Setup. But if your remote loses its pairing with the TV for some reason, you can easily re-pair it using either of the following methods:

1. Remove the battery cover from the back of the remote.

2. Press and hold down the pairing button for 3 seconds or longer, until the adjacent LED lights up.

3. Do one of the following:

    - Turn on the TV using the power button on the TV side or back panel. Pairing occurs as the TV starts up.

    - Use the Roku mobile app or a different remote to navigate to Settings > Remote > Pair remote.

Tip: *If the remote fails to pair with the TV, try installing new batteries. Also, it's helpful to hold the remote within two to three feet of the TV to ensure successful pairing.*

Checking the Roku voice remote battery level

You can check the condition of the batteries in your Roku voice remote at any time by navigating to Settings > Remote > Battery level. The resulting screen displays not only the

battery level, but also other information that can be useful when you need technical support with your remote.

Tip: *When you first turn on the TV, a battery level indicator appears in the upper right corner of the screen for a few seconds.*

Finding your Roku Enhanced Voice Remote

Only on TVs with the Roku Enhanced Voice Remote, when your remote has found its way down into the sofa cushions or your dog has hidden it in the corner, you can use the Find Remote feature to find out where it's hiding. This feature has a limited range, and is designed to find your Enhanced Voice Remote somewhere in the same room as the TV.

Select Find Remote on the Settings > Remote menu to see brief instructions on how to activate the Find Remote feature. Note, however, that selecting this option doesn't actually activate the feature. Here are the complete instructions:

Activate Find Remote

- If your TV has a joystick-style control, press to the Left or Right to open the Inputs menu, and then press Right to scroll down to Find Remote.
- If your TV has a column of labeled panel buttons, press the INPUT button to open the Inputs menu, and then press the INPUT button again until you highlight Find Remote.
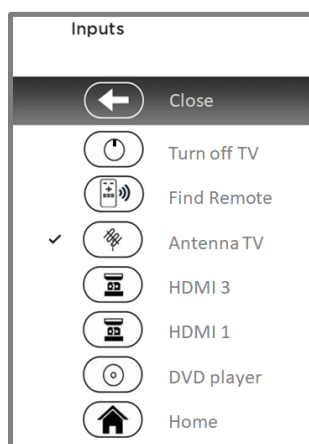
A moment or two after highlighting Find Remote, the Roku Enhanced Voice Remote starts playing your selected Find Remote sound to let you know where it is hiding. The sound automatically stops after a minute, or after you find the remote and press any button.

Changing and previewing the Enhanced Voice Remote finder sound

Only on TVs with the Roku Enhanced Voice Remote, you can customize the sound your remote makes when you use the Find Remote feature. To customize the sound, navigate to Settings > Remote > Change remote finder sound. Select the sound you want to use from the available settings.

To preview the sound you have chosen, select Preview remote finder sound, and then hold down OK on the remote to play the sound. When you release the OK button, the sound will stop.

Adjusting TV settings

You can adjust most picture and sound settings while you are watching a program by pressing ✱ to open the Options menu. There are some additional picture and sound settings in the Settings menu.

In most cases, the changes you make apply only to the input you are using. Antenna TV, the separate HDMI® inputs, and the AV input each have their own settings that the TV remembers when you return to that input. The TV also separately remembers the settings you specify while viewing streaming content.

Settings menu

Use the Settings menu to adjust overall TV settings. Press ⌂ to go to the Home screen, and then navigate to Settings > TV picture settings.

You can adjust the following overall TV picture settings from the Settings screen:

- TV brightness – Provide a better viewing experience in darker or brighter rooms. Increases or decreases the TV's general brightness across all TV inputs.

  Note: *This setting is identical to the TV brightness setting you can access in the Options menu while watching a program.*

- HDR notification – *On select models only*: Controls whether the TV displays a notification in the upper right corner of the screen for a few seconds when HDR or Dolby Vision content begins to play.

  - On – The TV displays a notification when HDR or Dolby Vision content begins to play.

  - Off – The TV does not display a notification when HDR or Dolby Vision content begins to play.

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Note: *This setting does not affect the HDR or Dolby Vision notification that always appears in the program information banner. Press OK while watching a show to open the program information banner.*

- Settings per input – Lists each TV input. Select an input, and then press ✱ to display the Options menu where you can adjust the input's settings while watching a live picture and listening to the sound from that input.

  Tip: *You don't have to go to the Settings menu first—you can display an input's Options menu and adjust its settings whenever you are watching the input by pressing ✱.*

Options menu

The Options menu for each TV input provides many settings for controlling the appearance of the picture and the quality of the audio. To view the Options menu, press ✱ whenever you are watching a TV input or streaming a video (except when you are viewing the program information banner). The Options menu is a panel that appears over the left side of the screen:
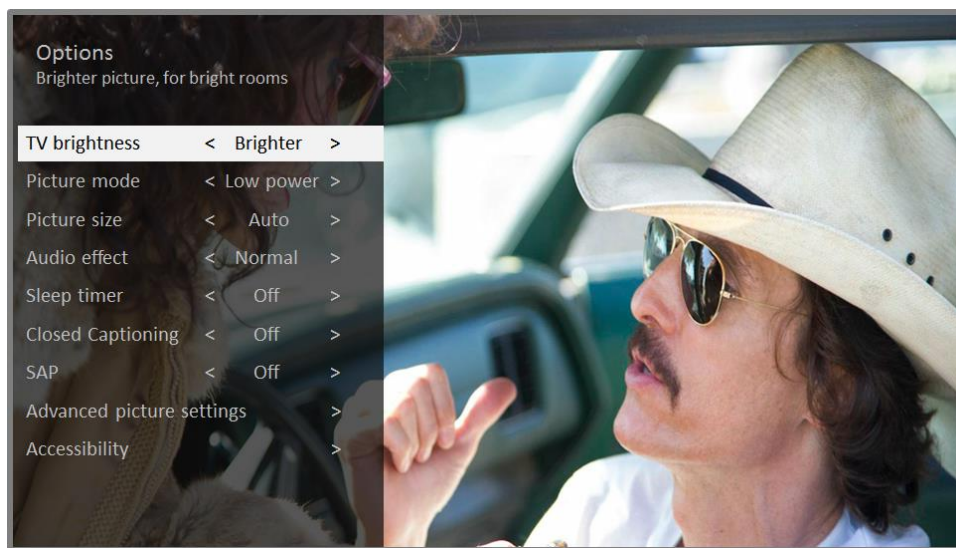
Typical Options menu

To adjust the settings on the Options menu, press the UP or DOWN arrow to highlight a setting, and then press the LEFT or RIGHT arrow to change the setting. You'll see the changes you make right away in picture appearance or audio quality.

Tip: *When you highlight a setting, the header text explains the effect of its current value. When you begin to adjust a setting, the other options are hidden so you can see more of the screen. Even though the other settings are hidden, you can move the highlight up or down to adjust the other settings. As soon as you press the UP or DOWN arrow, the other settings become visible again.*

Options menu settings

- TV brightness – Affects the overall brightness of the picture. *This setting applies across the entire TV; that is, to all TV inputs and is identical to the TV brightness setting under Settings > TV picture settings.*

- Picture mode – Provides picture presets for various viewing preferences. *This setting applies to the currently-selected input only.*

- Picture size – Adjusts the aspect ratio of the picture, enabling you to view a picture in its original format, or zoom or stretch it to fill the screen. The Auto setting has been found to produce the best picture in most cases.

- Audio effect – Adjusts the sound quality output from the TV speakers. *This setting applies across the entire TV; that is, to all TV inputs.* It does not affect the sound quality for headphones, HDMI (ARC), or SPDIF (TOSLINK) connectors.

- Sleep timer – Sets a timer that turns off the TV after the specific amount of time. *This setting remains in effect even if you stop watching the current input.*

- Closed captioning – Controls when you see captions. *This setting is only offered for Antenna TV, the AV input, and streaming videos. Any set value remains in effect across only these inputs.*

  o Antenna TV – Set captions to off, always on, on only when the TV sound is muted, or on only during instant replay (when Live TV Pause has been enabled).

  o AV input – Set captions to off, always on, or on only when the TV sound is muted.

  o Streaming video channel – For streaming content that provides closed captions, set captions to off, always on, on only when the TV sound is muted, or on only

during instant replay (for streaming content that supports instant replay). *Note that some streaming channels have other methods for turning captions on and off. In these cases, the Closed captioning option does not appear on the Options menu.*

Note: *If the ↺ button is not available on your remote, you can use this feature in the Roku mobile app. For more information, see* [Getting and using the Roku mobile app](#)*.*

- Captioning track – *Only in Canada*: Selects which caption track to display when Closed Captioning is on. *This setting remains in effect on all inputs that provide captions.*

   Note: *Only in the United States, the Captioning track setting is located under Accessibility.*

- SAP – Selects whether to play a secondary audio program or multichannel television sound, and which choice to play. *This setting applies only to Antenna TV on digital channels.*

- Advanced audio settings – *Only on select models*: Shows the [Advanced audio settings menu](#).

- Advanced picture settings – Shows the [Advanced picture settings menu](#).

Tip: *To dismiss the Options menu, just wait a few seconds without pressing any buttons. Or press ✱ again to dismiss the menu immediately.*

Accessibility (U.S. only)

Only in the United States, the settings on the Accessibility menu enable you to change the TV's accessibility settings without leaving the program you are watching. These settings are also available on the Home screen under Settings > Accessibility.
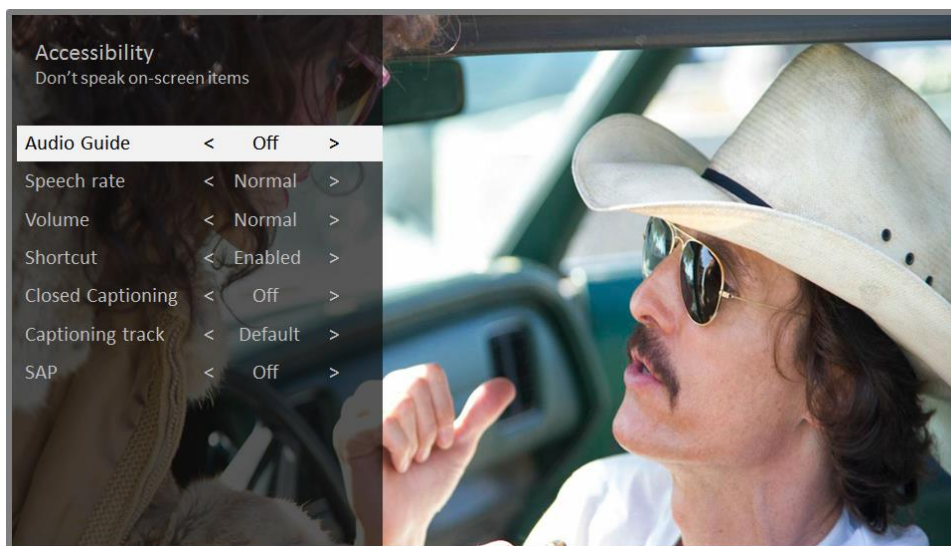
Accessibility menu settings

- Audio Guide – Turn the Audio Guide on or off. The Audio Guide is a text-to-speech screen reader that helps blind and low-vision users navigate the Roku user interface and on screen menus. When enabled, the Audio Guide reads out text, menus, and other on-screen items.

  Tip: *If Shortcut is enabled, you can enable or disable the Audio Guide by pressing the* ✱ *four times in quick succession. (The* ✱ *button is located directly below the directional pad on the right side of the Roku remote.)*

- Speech rate – Choose the speed at which the TV speaks Audio Guide prompts.

- Volume – Set the volume of the Audio Guide in relation to the main TV volume.

- Shortcut – Enable or disable the shortcut feature. When disabled, pressing ✱ four times in quick succession does not enable or disable the Audio Guide.

- Closed captioning – Controls when you see captions. *This setting is only offered for Antenna TV, the AV input, and streaming videos. Any set value remains in effect across only these inputs.*

  o Antenna TV – Set captions to off, always on, on only when the TV sound is muted, or on only during instant replay (when Live TV Pause has been enabled).

  o AV input – Set captions to off, always on, or on only when the TV sound is muted.

  o Streaming video channel – For streaming content that provides closed captions, set captions to off, always on, on only when the TV sound is muted, or on only during instant replay (for streaming content that supports instant replay). *Note that some streaming channels have other methods for turning captions on and off. In these cases, the Closed captioning option does not appear on the Options menu.*

  Note: *If the ↺ button is not available on your remote, you can use this feature in the Roku mobile app. For more information, see* [Getting and using the Roku mobile app](#)*.*

- Captioning track – Selects which caption track to display when Closed Captioning is on. *This setting remains in effect on all inputs that provide captions.*

- SAP – Selects whether to play a secondary audio program or multichannel television sound, and which choice to play. *This setting applies only to Antenna TV on digital channels.*

Video description through Secondary Audio Program (SAP)

Video description is audio descriptions of the action in a program, to help individuals who are blind or visually impaired enjoy the program. You enable video description by selecting one of the Secondary Audio Program (SAP) options.

To hear video description narrations in programs that have them, turn on SAP. If there are multiple SAP options for a channel, such as Spanish and French, try each one to determine which setting carries the video description track.

Note: *Broadcasters provide video descriptions only on a small number of programs. If you are unable to hear video descriptions after following these instructions, the program you are viewing does not provide them.*

For more details about video description, go to:

https://www.fcc.gov/consumers/guides/video-description.

Advanced audio settings – DTS TruSurround (select models only)

This topic describes the Advanced audio settings menu for TV models with DTS TruSurround. Each TV input has separate settings for fine tuning sound quality. All of the settings in this menu apply only to the currently-selected input. To use the Advanced audio settings menu, first press ✱ to display the Options menu. Then select Advanced audio settings.
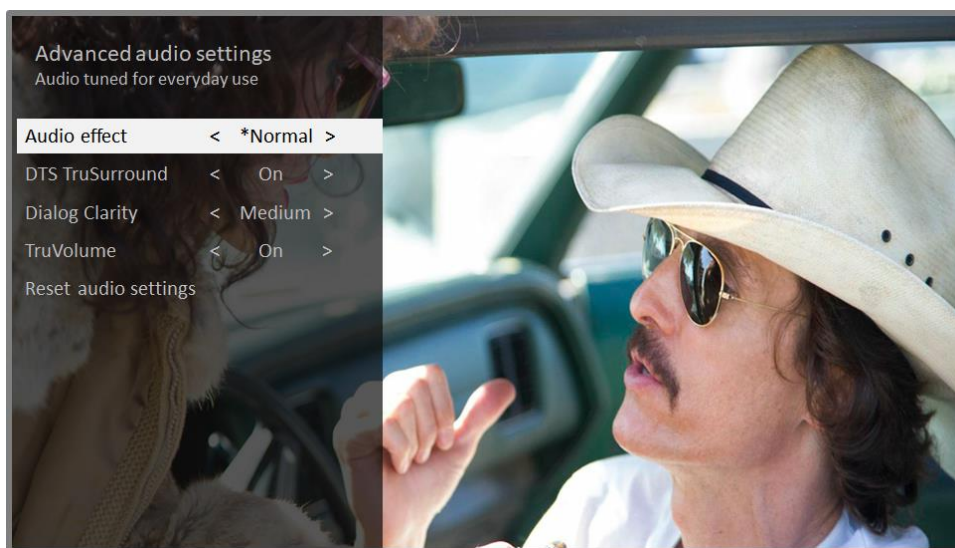
Advanced audio settings menu for models with DTS TruSurround

Advanced audio settings menu options – DTS TruSurround

- Audio effect – Select from among various preset audio modes to improve speech, make music sound its best, boost bass or treble, or simulate a theater. Use Reset audio settings, described below, to return the input's current settings to their original values.

- DTS TruSurround –Simulates surround sound that otherwise would require installation of a surround sound audio system. Sometimes, the effect interferes with dialog clarity. Use the Dialog Clarity option to compensate.

- Dialog Clarity – Available only when DTS TruSurround is On. Choose among Low, Medium, and High settings to improve the clarity of dialog when you are using the TruSurround feature.

- TruVolume – Minimizes annoying volume fluctuations in programs.

- Reset audio settings – Returns DTS TruSurround, Dialog Clarity, and TruVolume settings, to their default settings for the selected Audio effect.

Advanced audio settings – Sonic Emotion Premium (select models only)

This topic describes the Advanced audio settings menu for TV models with Sonic Emotion Premium. Sonic Emotion Premium is an audio technology that enables your TV to produce a more immersive sound experience. Each TV input has separate settings for fine tuning sound quality. All of the settings in this menu apply only to the currently-selected input. To use the Advanced audio settings menu, first press ✱ to display the Options menu. Then select Advanced audio settings.
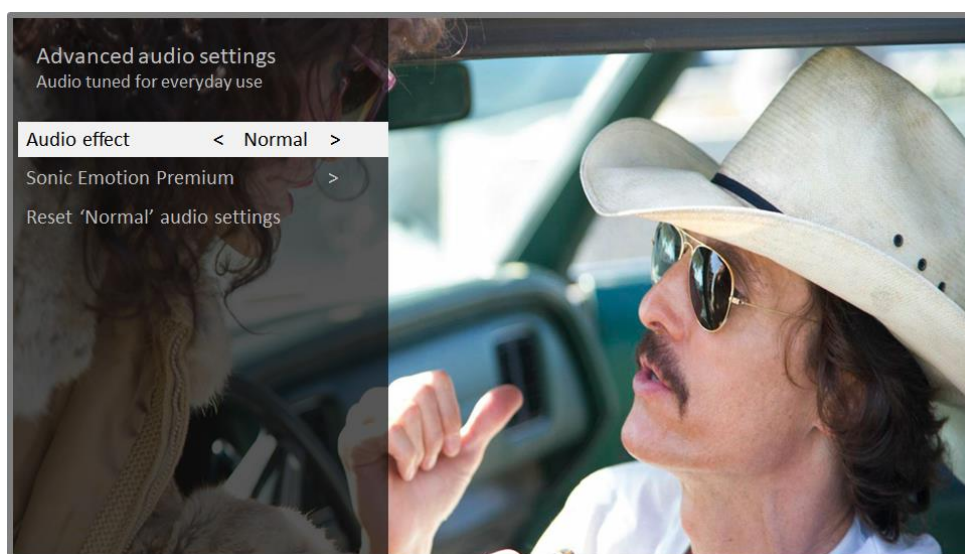
Advanced audio settings menu for models with Sonic Emotion Premium

Advanced audio settings menu options – Sonic Emotion Premium

- Audio effect – Select from among various preset audio modes to improve speech, make music sound its best, boost bass or treble, or simulate a theater. Use Reset audio settings, described below, to return the input's current settings to their original values.

- Sonic Emotion Premium – Displays a menu with individual Sonic Emotion audio settings, as described in Sonic Emotion.

- Reset audio settings – Returns Sonic emotion settings to their default settings for the selected Audio effect.

Sonic Emotion settings

When you turn on Sonic Emotion from the Advanced audio settings menu, these additional settings become available:
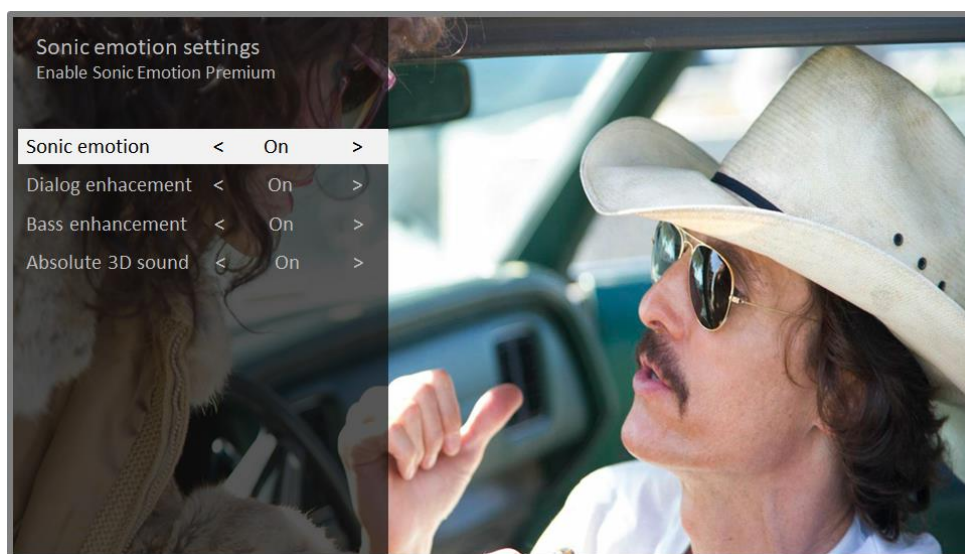
- Dialog Enhancement – Enhances your ability to hear and understand dialog in the program.

- Bass Enhancement – Enhances the low frequency sound component in the program.

- Absolute 3D Sound – Simulates sound from multiple speakers that would otherwise require installation of a surround sound audio system.

Advanced picture settings

The Advanced picture settings menu for each TV input provides settings for fine tuning the appearance of the picture. All of the settings in this menu apply only to the currently-selected input.

To use the Advanced picture settings menu, first press ✱ to display the Options menu. Then select Advanced picture settings.

Typical Advanced picture settings menu

Advanced picture settings menu options

- Picture mode – Provides picture presets for various viewing preferences. This setting duplicates the one on the Options menu. When you change the Picture mode, other picture settings adjust accordingly. For example, setting the Picture mode to Vivid sets Brightness, Contrast, Sharpness, and other values to produce a very vibrant picture. Setting Picture mode to Movie changes the settings to produce a picture suitable for enjoying movies in a darkened room. If you make changes to the individual picture settings—for example, Contrast, or Sharpness—these settings are saved for the current input *and* the current picture mode. In this way, you can set HDMI 1 input's Movie picture mode to use different settings than the HDMI 2 input's Movie picture mode and Antenna TV's Movie picture mode. Use Reset picture settings, described below, to return the input's selected picture mode to its original values.

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- Local contrast – *Only on select models*: Sets the amount of dimming multiple "local" areas of the screen's backlight intensity. This setting can make dark areas darker without affecting the brightness of light areas. *This option is disabled when Game mode is enabled.*

- Dynamic contrast – *Only on select models*: Automatically adjusts the backlight level to achieve the optimum contrast and prevent excessive differences between light and dark areas of the screen. *This option is disabled when Local dimming/Local contrast is enabled.*

- Backlight - Adjusts the overall light intensity of the screen. *On some models, this option is disabled when Dynamic contrast is enabled.*

- Brightness – Adjusts the dark level of the black areas of the picture.

- Contrast – Adjusts the white level of the light areas of the picture.

- Sharpness – Adjusts the sharpness of the edges of objects in the picture.

- Color – Adjusts the intensity of colors in the picture. A setting of 0 removes all color and displays a black and white picture.

- Tint – Adjusts the color balance from green to red to obtain accurate colors in the picture.

- Color temperature – Adjusts the overall colors in the picture from Normal to slightly more bluish (Cool) to slightly more reddish (Warm).

- Action smoothing – *Only on select models:* Adjusts the amount of action smoothing applied to the video signal. A higher setting results in more smoothing, but can cause undesirable picture artifacts in certain types of content. *Each Picture mode has a different Action smoothing default setting.*

- Natural Cinema – *Only on select models:* When enabled, this feature reduces "judder" that is often present when 24 frame-per-second movies are upscaled to 60Hz TV standards. Natural Cinema mode is On by default in Movie and HDR Dark picture modes, and Off by default in other picture modes. When Natural Cinema mode is On, Action smoothing is turned off and disabled.

- Action clarity – *Only on select 120Hz models:* Reduces blur, especially for fast-moving images such as sports.

- LED action clarity – *Only on select models:* Reduces motion blur caused by LED backlight latency. Enabling this feature inserts black frames between picture frames in a way that improves the clarity of fast movement. It provides an improved viewing experience for video games and sporting events. When LED action clarity is enabled, the Brightness and Dynamic contrast settings are disabled. You can choose settings of Low, Medium, High, or Off to achieve the desired picture quality. Enabling Game mode sets LED action clarity to Medium.

- Game mode – *Only on HDMI$^{®}$ and AV inputs:* Controls whether Game mode is enabled. When On, the TV performs less image processing and has less input lag. When Off, the TV performs more image processing and has more input lag, which is less desirable for action games.

- Reset picture settings – Returns all picture settings for the input's currently-selected Picture mode to their original values.

Tip: *To dismiss the Advanced picture settings menu, just wait a few seconds without pressing any buttons. Or press ✱ again to dismiss the menu immediately.*

Expert Picture Settings (4K models only)

4K (UHD) TV models have additional picture settings for demanding home theater enthusiasts. Expert Picture Settings include gamma, noise reduction, 11 point white balance adjustment, and extended color management.

You can access Expert Picture Settings only by using the Roku Mobile App on an iOS$^{®}$ or Android™ mobile device. For more information, go to the following link on the Roku web site:

go.roku.com/expertpicturesettings

Changing privacy settings

Note: *Privacy settings are not present on TVs operating in non-connected mode.*

Advertising

Only in connected mode, by default your TV uses an advertising identifier to track your TV usage. You can change the privacy settings on your TV in two ways: resetting the advertising identifier and limiting ad tracking.

Reset the advertising identifier

Resetting the advertising identifier clears the prior usage history that your TV stores, and then begins tracking again. From that point forward, your new usage patterns affect the advertisements you see on your TV.

1. From the Home screen menu, navigate to Settings > Privacy > Advertising.

2. Highlight Reset advertising identifier. Press ✳ to view more information about this option. When you finishing reading the information, press OK to close the More Information window.

3. Press OK to reset the advertising identifier, and then press OK again to dismiss the verification message.

Limit ad tracking

You can limit Roku's tracking of your usage behavior by limiting ad tracking. When you do, your TV will display ads that are not personalized based on your TV's advertising identifier.

1. From the Home screen menu, navigate to Settings > Privacy > Advertising.

2. Highlight Limit ad tracking. Press ✳ to view more information about this option. When you finish reading the information, press OK to close the More Information window.

3. Press OK to select the Limit ad tracking check box.

Note: *If you perform a factory reset and then reconnect your TV, ad tracking is restored until you repeat these steps.*

Microphone

Your Roku TV does not have a built-in microphone. However streaming channel providers can use the microphone on the Roku voice remotes (only on select models) or on your mobile device when the Roku mobile app is running. You can control whether streaming channels have permission to use the microphone.

Note: *These settings affect only streaming channel access to the microphone. They do not affect your Roku TV's Voice Search feature.*

Channel microphone access

You can control which streaming channels have permission to use the microphone, giving you control over how the microphone is used by each streaming channel. The default setting is Prompt, so no channel will be able to turn on the microphone without your permission.

To change microphone access settings:

1. From the Home screen menu, navigate to Settings > Privacy > Microphone.

2. Select Channel microphone access.

3. Choose one of the following settings:

   - Prompt – Display a notification each time any streaming channel requests the use of the microphone. When a notification appears, you can choose among Prompt, Always allow, and Never allow on a per-channel basis.

   - Always allow – Do not prompt, but always allow any streaming channel to use the microphone.

   - Never allow – Do not prompt, but never allow any streaming channel to use the microphone.

Channel permissions

After granting or denying microphone access on a per-channel basis, you can reset channel permissions to enable them to follow the system-wide setting you specify under Channel microphone access.

To reset channel permissions:

1. From the Home screen menu, navigate to Settings > Privacy > Microphone.

2. Select Channel permissions.

3. Highlight Reset channel permissions, and then press OK.

My Feed

Only in connected mode, use My Feed to find out when you can watch movies coming soon, and to get updates on movies, TV shows, and actors that you are following.

Movies Coming Soon

My Feed gives you updates on your list of movies that are coming soon to theaters. With My Feed, you'll know when your favorite movie is ready to stream, the channels it is on, and how much it will cost.

Select the movies you want to follow by going to My Feed > Movies Coming Soon. You'll then see a list of newly released movies that are not yet available on Roku streaming devices. Select a movie, and then select Follow this movie on Roku. When you return to the main My Feed screen, you'll see banners for each of your newly-followed movies along with banners for movies and TV shows you're already following.

Movies, TV shows, and people

In addition to following movies coming soon, you can follow any movie, TV show, or actor across top streaming channels. To follow a program, use the Search feature to find the movie, TV show, or name that you want to follow, and then select Follow this movie/TV show/person on Roku. For more information, see [Searching for something to watch](#).

Note: *The TV takes a bit of time to update your newly-followed shows. Until it finds at least one channel offering the movie, the content banner in My Feed shows Check back later for updates.*

My Feed alerts you any time a movie or TV show you are following becomes available on another channel and whenever its price changes. A number in parentheses next to My Feed in the Home screen menu means that My Feed has updated information that you haven't viewed yet. For example, if three of your followed shows have updates, you'll see My Feed (3).

Note: *When a movie or TV show you are following becomes available, the streaming channel offering the movie might require that you subscribe or pay a fee to view it.*

Searching for something to watch

Searching for movies and shows across both Antenna TV (*only in the United States*) and streaming channels is one of the unique features of your Roku TV. Within a single search operation, you can search by:

- Movie name
- TV show name
- Actor or director name
- Streaming channel name
- Game name

Note: *Roku Search is not available if your TV is operating in non-connected mode. Roku Search doesn't search across all streaming channels, but searches across lots of popular streaming channels. The actual channels it searches vary by locale.*

How do I search?

You can search by using an on-screen keyboard that you navigate using the arrow keys on your remote, or *only in the United States*, you can use a Roku voice remote or the Roku mobile app to search with your voice.

For more information about Voice Search, go to go.roku.com/voicesearch.

Keyboard search using the remote

1. Select Search on the Home screen menu.

    The Search screen has a keyboard grid and initially displays instructions—a set of icons representing search categories and a list of participating provider tiles.

    Tip: *If you don't see the instructions, navigate to the end of the list of recent searches and select Clear recent search selections.*

2. Use the arrow keys to navigate the on-screen keyboard, entering a few characters of the search term.

    With each additional character you enter, you narrow down the search, making the search results more relevant. You'll often see the results you are seeking after entering only a few letters.

3. When you see the show you are searching for, navigate to the right to highlight it.

Voice Search from a Roku voice remote

Only in the United Stated with models that have a Roku Voice Remote or Roku Enhanced Voice Remote:

1. Press and hold the search button, either 🎤 or 🔍.

2. Say the name of a movie, TV show, actor, or director.

    The TV lists the results of your search across many streaming and Antenna TV channels. An icon next to each search result shows the category of the result (movie, TV show, actor).

3. Press the RIGHT arrow to move the highlight into the list of search results.

4. Press the UP and DOWN arrows to scroll through the list of search results to highlight the item you want to view.

Searching from the Roku mobile app

Use the free Roku mobile app on your compatible smartphone or tablet to make searching even faster. Use your mobile device's keypad to type more quickly and easily than with the on-screen keyboard on your TV. *Only in the United States*, you also can search simply by touching the Voice Search icon and saying the name of the movie, TV show, actor or director, streaming channel, or game.

When you use the Roku mobile app to search, search results are shown on your mobile device instead of on the TV screen. When you make a selection from the search results, the TV starts playing the selected program.

For more information, see Getting and using the Roku mobile app.

I found a show, now what?

Now that you've highlighted the show, movie, actor, game, or streaming channel you were looking for, press the RIGHT arrow.

If your search result was an actor, director, or other item that does not represent a single item of content, you'll see another list to narrow down your search. Continue highlighting results and pressing the RIGHT arrow until you find a single, viewable content item.

- The channel logo appears to the left of each result.
- *Only in the United States*, a LIVE TV logo indicates a program that is available on Antenna TV. Shows currently playing live appear at the top of the list. Shows airing in the future appear at the bottom of the list. Selecting a LIVE TV result switches the TV to that channel regardless of whether the program is currently in progress.
- An *HD* logo means that the content is available in high-definition.
- The checked circle adjacent to the title means you have already added the streaming channel.

If your search result was a game or a streaming channel, you'll see detailed information, images, and available actions, such as a list of streaming channels and the cost of getting the item or channel.

Note: *Some channels may require a paid subscription.*

Follow on Roku

Rather than watch the show you found in Search, you can add it to My Feed and wait until it's available on a particular streaming channel or available at a better price. From the search results screen, select Follow on Roku. Then go to My Feed periodically to check for updates to each of your followed movies, TV shows, or people. For more information, see My Feed.

Recent Searches

The next time you use Roku Search, the Search screen displays a list of recent search selections in place of the search instructions.

Using the recent search selections list makes it easy to quickly get to a previously found item, for example, to find another movie with the same actor, or another TV show in the same series.

Using the Roku Channel Store

Only in connected mode, the Streaming Channels menu option takes you to the Roku Channel store, where you can add new subscription based and free streaming channels to your TV.

Tip: *You also can search for streaming channels by using the Search option, as explained in* [Searching for something to watch](#)*.*

To make it easier to find what you want, the streaming channels in the Roku Channel Store are categorized by topic. Press the UP and DOWN arrows to highlight the category you want, and then press the RIGHT arrow to move the highlight into the grid of streaming channel tiles.

When you find a streaming channel you want to add or learn more about, highlight it and press OK to display more details.

- If the streaming channel you are adding is free, you can select Go to channel to start watching it immediately.
- If there is a one-time or recurring fee associated with using the streaming channel, you must agree to the terms and conditions, accept the fee, and—if you created one when you activated your Roku TV, enter your Roku PIN code to authorize the charges.
- If you already have a subscription to the streaming channel—for example, you already subscribe to Netflix or you receive HBO through your cable TV provider—you must complete a different, simple authorization step to add the streaming channel.

You need only complete the authorization or activation step one time, when you initially add the streaming channel. After that, you simply select the streaming channel tile from your Home screen to start watching. (Channel and content availability is subject to change. Charges may apply to your selection.)

Tip: *New streaming channels are added continuously to the Roku Channel Store, so be sure to check back every now and then for new options.*

Note: *If you don't remember your PIN, or if want to change whether you need to use a PIN to make purchases on your Roku account, see* *Changing your Roku Channel Store PIN preference*.

Customizing your TV

There are several things you can do to personalize your TV.

Add TV inputs

As you use your TV, you might find that you need to add a TV input tile that you did not add during Guided Setup. To add a TV input:

1. From the Home screen menu, navigate to Settings > TV inputs. Notice that the list of inputs is divided into two sections: Inputs being used and Inputs not used.

2. Press the UP or DOWN arrows to highlight an input in the Inputs not used section of the list.

3. Press the RIGHT arrow to move the highlight to Set up input.

4. Press OK to add the input.

5. Press ⌂ to return to the Home screen. Notice that the input has been added to the top of the Home screen. If you want to move the input tile to a different position in the grid, see Rearrange tiles.

Add streaming channels

You can add streaming channels by searching in the Roku Channel Store. New streaming channels are added to the bottom of the Home screen. If you want to move the channel tile to a different position in the grid, see Rearrange tiles.

Rename inputs

Rather than trying to remember that your Blu-ray™ player is connected to HDMI 1 and your game console is connected to HDMI 3, you can rename the TV inputs to match the connected device.

Note: *Renaming an input also changes the icon associated with it.*

To rename an input, you can either:

- Highlight the input tile in the Home screen, and then press ✷ to display a list of options. From the list of options, select Rename input. Then select a new name and icon.

or

- From the Home screen, navigate to Settings > TV inputs. On the TV inputs screen, select the input you want to rename, select Rename, and then choose a new name and icon from the provided list.

Rather than using the predefined names and icons, you can set a custom name and icon. To do so, scroll up or down to highlight Set custom name & icon, and then press OK. Follow the instructions on the screen to enter a name and select an icon for the input.

Press ⌂ to return to the Home screen. The new name and icon are now in effect.

Remove unwanted tiles

It's easy to remove unused TV inputs and unwanted channel or app tiles. For example, if you never use the HDMI 3 input, or if you don't like the weather app you added from the Roku Channel Store, you can remove them from your Home screen.

Note: *You also can remove the Antenna TV tile if you never use the TV tuner. But be aware that removing the Antenna TV tile also deletes the channel list. You'll have to set up the TV tuner again next time you want to view Antenna TV. Instructions for setting up the TV tuner can be found in* [Setting up Antenna TV](#)*.*

- To remove any tile, highlight the input tile in the Home screen, and then press ✱ to display a list of options. From the list of options, select Remove input. In the screen that follows, confirm you want to remove the input.

- Alternatively, to remove a TV input tile from the Home screen, navigate to Settings > TV inputs. On the TV inputs screen, select the input you want to remove, and then select Remove > Confirm. Then press ⌂ to return to the Home screen.

Rearrange tiles

When you add a TV input tile, it's added at the top of your Home screen. When you add a new streaming channel, it's added at the bottom of your Home screen.

You can easily rearrange the order of the tiles on the Home screen to suit your viewing preferences. For example, you might want Antenna TV to be the first tile in your Home screen. But if you mostly watch one streaming channel, you might want its tile to be the first one on your Home screen.

1. From the Home screen, highlight one of the tiles you want to move.

2. Press ✱ to display a list of options for the type of tile you selected.

3. Select Move input or Move channel. The list of options disappears and the highlighted tile shows arrows indicating how it can be moved.
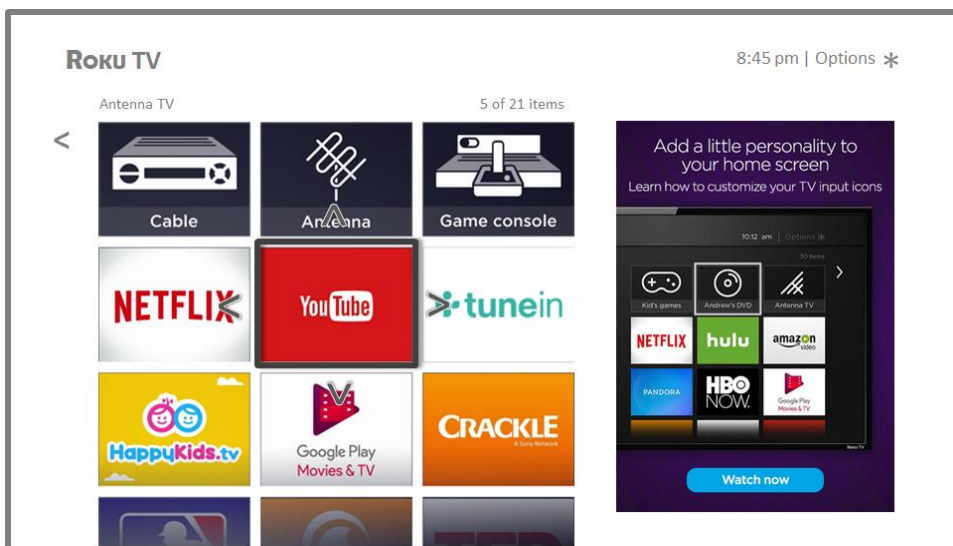
Note: *A paid subscription or other payments may be required for some channels. Channel availability is subject to change and varies by country. Not all content is available in countries or regions where Roku® products are sold.*

4. Use the arrow keys to move the highlighted tile to its new position. As you move the tile, it pushes other tiles out of its way.

5. Press OK to lock the tile into its new position.

6. Repeat these steps to move other tiles until you have arranged your Home screen to your liking.

Change themes

Only in connected mode, another way to customize your TV is to change its theme. The theme establishes the look and feel of the TV through colors, designs, and fonts. Some themes require payment.

To change the theme, in the Home screen menu navigate to Settings > Themes. In the Themes screen, choose from the following options:

- My themes – Highlight a theme, and then press OK to switch to that theme.

- Get more themes – Highlight this option at the bottom of the My Themes list, and then press OK to shop for new themes.

- Custom settings – Turn Featured themes on or off. When Featured themes is on, the TV automatically switches to featured themes—like certain holiday-inspired themes —for a limited time whenever Roku makes them available, and then switches back to your selected theme when the featured theme expires. When off, the TV uses your selected theme.

Edit Antenna TV channel lineup

When you set up the TV tuner as described in Setting up Antenna TV, the TV adds all the channels with good signals that it can detect in your area. It's likely that you now have more channels than you want in your channel list.

To edit the channel lineup, from the Home screen, navigate to Settings > TV inputs > Antenna TV > Edit channel lineup. You'll see a screen listing all of your channels. Adjacent to the list of channels is a miniature TV screen playing the highlighted channel's picture and sound.
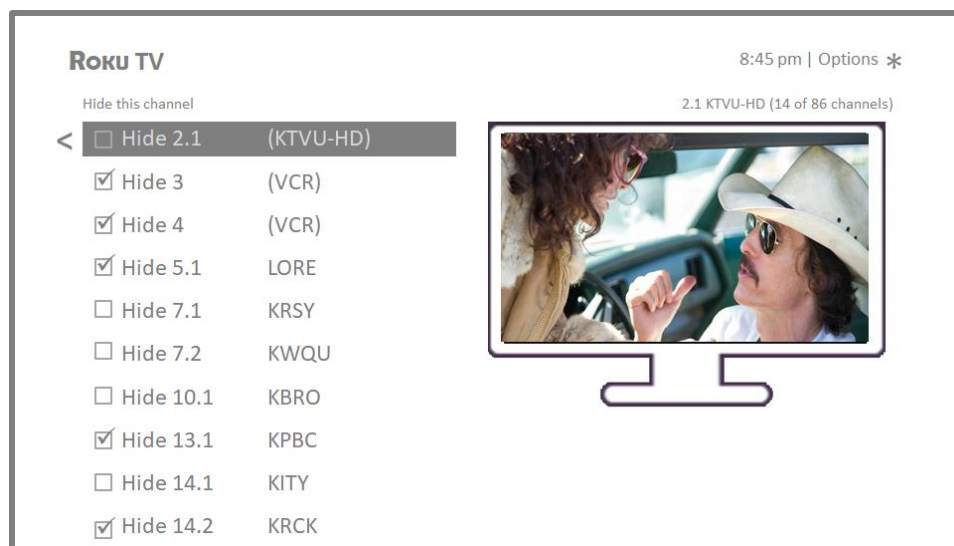
Highlight each channel you want to hide, and then press OK to hide the channel.

Tip: *If you need to see or hear the highlighted channel, wait a couple of seconds for the TV to start playing the channel's picture and sound. Also note that if you've enabled parental controls and the program on the current channel is blocked, you won't see a picture or hear sound while editing the channel lineup.*

Note: *Repeating the tuner channel scan unhides all hidden channels.*

Change sound effects volume

Sound effects are the noises the TV makes to let you know it received your command. You can change the volume of sound effects or turn them off.

To adjust the sound effects volume, in the Home screen menu, navigate to Settings > Audio > Menu volume. Navigate to the right and then change the setting to High, Medium, Low, or Off.

Configure power settings

Power settings let you configure features related to how your TV's power settings work.

Power on settings

Power on settings tell the TV what to do when you turn on the power. To configure the power on settings, from the Home screen, navigate to Settings > System > Power > Power on. Highlight the preferred power on location in the list, and then press OK.
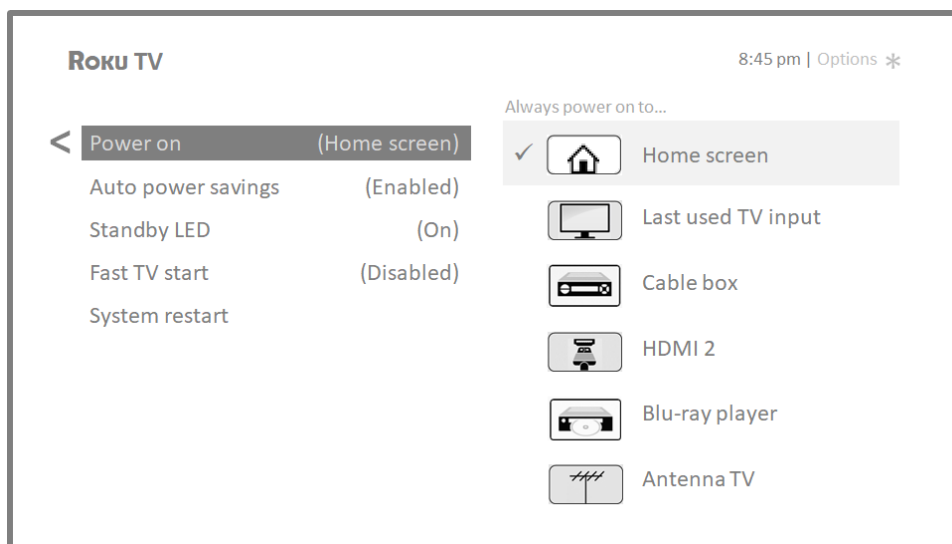
Auto power savings

To help you save energy, your TV can automatically turn itself off after a period of inactivity or a period during which no signal has been detected. It is factory-configured to do both of these things, but you can change these settings if needed.

To configure automatic power off, from the Home screen menu navigate to Settings > System > Power > Auto power savings. In the Power settings screen, highlight the following options and press OK to turn them on or off:

- Reduce power after 15 minutes – If no video or audio activity and no user interaction occur for 15 minutes, the TV automatically turns off the screen and sound.
- Turn off after 4 hours – If no video or audio activity and no user interaction occur for 4 hours, the TV goes into standby mode.

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Standby LED On/Off

Normally, the status LED on the front of your TV is lit whenever the TV is in standby mode. If you prefer the status LED to not be lit in standby mode, you can turn it off. To do so, from the Home screen, navigate to Settings > System > Power > Standby LED, and then select Off.

After making this change, the status LED still performs all other indication functions.

Fast TV start

Only in connected mode on TV models that are not Energy Star certified, you can enable Fast TV start. As you might expect, Fast TV start lets you start watching your TV almost instantly after turning it on. But it also enables other convenient features, such as the ability to turn on your TV using voice commands or the Roku mobile app.

Be aware that enabling Fast TV start makes your TV use somewhat more power when it is powered off to standby mode.

Configure accessibility (U.S. only)

Accessibility settings enable users with vision or hearing impairment to use the TV more effectively. Accessibility settings are located under Settings > Accessibility.

Captions mode

The Captions mode settings specify when closed captions appear. Access caption settings from the Home screen by selecting Settings > Accessibility > Captions mode. At this point, you can choose among the following options:

- Off – No captions appear.

- On always– Captions appear whenever they are available from the program source.

- On replay– Captions appear only when you use the replay feature, and only when you are watching a streaming program that supports instant replay or watching a TV channel after enabling Live TV Pause.

- On mute – Captions appear only when the TV is muted.

Tips:

- *You can change the captions mode while watching a program. Press ✱ to display the Options menu, and then select Closed Captioning.*

- *Some streaming channels require you to enable captions through a setting within their channel even though you have turned on captions in the TV settings.*

Note: *Once enabled, the selected captions mode applies to all inputs that support captions and remains enabled until you turn it off.*

Captions preferred language

The Captions preferred language setting lets you select the language in which you want closed captioning to appear, when that language is available. If your preferred language is not available, then captioning reverts to the default language for the program, which usually is English.

Highlight the language you prefer, and then press OK to select it.

Captions style

The Captions style settings let you control how closed captions look when displayed on your TV. Access caption style settings from the Home screen by selecting Settings > Accessibility > Captions style. At this point, you can choose among the following options:

- Text style – Choose from a list of fonts. As you move the highlight to each font, you can see a sample of the result in an adjacent panel.

- Text edge effect – Choose from a list of edge effect styles, such as raised, depressed, and various shadows. As you move the highlight to each effect, you can see a sample of the result in an adjacent panel.

- Text size – Choose from a list of sizes. As you move the highlight to each size, you can see a sample of the result in an adjacent panel.

- Text color - Choose from a list of colors for the text. As you move the highlight to each color, you can see a sample of the result in an adjacent panel.

- Text opacity - Choose from a list of opacity settings for the text. This setting determines how much the area behind the text shows through the text. A value of 100% blocks all of the content behind the text. As you move the highlight to each setting, you can see a sample of the result in an adjacent panel.

- Background color - Choose from a list of colors for the background area behind the text. As you move the highlight to each color, you can see a sample of the result in an adjacent panel. Note that you won't see any change unless you set the Background opacity to a value other than Off.

- Background opacity - Choose from a list of opacity settings for the background of the caption. This setting determines how much the area behind the caption background shows through the background. A value of 100% blocks all of the content behind the background. As you move the highlight to each setting, you can see a sample of the result in an adjacent panel.

- Window color - Choose from a list of colors for the window rectangle surrounding the entire caption. As you move the highlight to each color, you can see a sample of the result in an adjacent panel. Note that you won't see any change unless you set the Window opacity to a value other than Default or Off.

- Window opacity - Choose from a list of opacity settings for the window rectangle surrounding the entire caption. This setting determines how much the area behind the caption window shows through the window. A value of 100% blocks all of the content behind the window. As you move the highlight to each setting, you can see a sample of the result in an adjacent panel.

Audio Guide settings

Audio Guide settings help users who are blind or visually impaired to configure the text-to-speech reader, enabling them to operate their TV more easily. Audio Guide uses voice prompts that speak volume and channel changes, menu options, and setting changes. Access Audio Guide settings from the Home screen by navigating to Settings > Accessibility, and then select from the following options in the Audio Guide section:

- Audio Guide – Turn Audio Guide on or off.

- Speech rate – Select one of four speeds at which to hear spoken guide information: Slow, Normal, Fast, or Very Fast.

- Volume – Select the volume at which to hear spoken guide information, relative to the main TV volume.

- Shortcut – Enable or disable the shortcut feature. When enabled (the default), pressing ✱ four times in quick succession enables or disables the Audio Guide.

Changing caption settings (Canada only)

On models sold in the United States, you can find caption settings under Settings > Accessibility > Captions mode and Captions style. On models sold in Canada, you can find captions settings under Settings > Captions.

Captions mode

- Off – No captions appear.

- On – Captions appear whenever they are available from the program source.

- Instant replay – Captions appear only when you use the replay option, and only when you are watching a streaming program that supports instant replay.

- When mute – Captions appear only when the TV is muted.

Tips

- *You can change the captions mode while watching a program. Press ✶ to display the Options menu, and then select Closed Captioning.*

- *Some streaming channels require you to enable captions through a setting within their channel even though you have turned on captions everywhere else.*

Note: *Once enabled, the captions mode applies to all inputs that support captions and remains enabled until you turn it off.*

Captions preferred language

Choose the language in which you want closed captioning to appear, when that language is available. If your preferred language is not available, then captioning reverts to the default language for the program, which usually is English.

Highlight the language you prefer, and then press OK to select it.

Other caption settings

- Text style – Choose from a list of fonts. As you move the highlight to each font, you can see a sample of the result in an adjacent panel.

- Text edge effect – Choose from a list of edge effect styles, such as raised, depressed, and various shadows. As you move the highlight to each effect, you can see a sample of the result in an adjacent panel.

- Text size – Choose from a list of sizes. As you move the highlight to each size, you can see a sample of the result in an adjacent panel.

- Text color - Choose from a list of colors for the text. As you move the highlight to each color, you can see a sample of the result in an adjacent panel.

- Text opacity - Choose from a list of opacity settings for the text. This setting determines how much the area behind the text shows through the text. A value of 100% blocks all of the content behind the text. As you move the highlight to each setting, you can see a sample of the result in an adjacent panel.

- Background color - Choose from a list of colors for the background area behind the text. As you move the highlight to each color, you can see a sample of the result in an adjacent panel. Note that you won't see any change unless you set the Background opacity to a value other than Off.

- Background opacity - Choose from a list of opacity settings for the background of the caption. This setting determines how much the area behind the caption background shows through the background. A value of 100% blocks all of the content behind the background. As you move the highlight to each setting, you can see a sample of the result in an adjacent panel.

- Window color - Choose from a list of colors for the window rectangle surrounding the entire caption. As you move the highlight to each color, you can see a sample of the result in an adjacent panel. Note that you won't see any change unless you set the Window opacity to a value other than Default or Off.

- Window opacity - Choose from a list of opacity settings for the window rectangle surrounding the entire caption. This setting determines how much the area behind the caption window shows through the window. A value of 100% blocks all of the content

behind the window. As you move the highlight to each setting, you can see a sample of the result in an adjacent panel.

Configuring parental controls

Parental controls enable you to control whether the members of your household can view certain kinds of broadcast TV programs. When a program or feature is blocked, you can unblock it by entering a parental control PIN that only you know.

Note: *Parental controls block content from the TV tuner and from streaming options, if any, on the Home screen menu. Parental controls do not block content on other TV inputs or content from streaming channels you add to your TV.*

Creating a parental control PIN

The first time you access the Parental controls screen, you must create a new parental control PIN. Thereafter, whenever you want to change parental control settings, unblock programming that has been blocked, change the PIN, or disable parental controls, you must enter your parental control PIN.

Tip: *Your parental control PIN has nothing to do with your Roku PIN. You can make them the same if you want—this is entirely your choice.*

To create a new parental control PIN, from the Home screen menu navigate to Settings > Parental controls. The screen displays a numeric keypad. Use the arrow keys and then press OK to enter a four digit code. Then repeat the process to enter the same PIN again, just to make sure you correctly entered the PIN you want to use.

Important: *If you forget your parental control PIN, the only way to recover is to perform a factory reset operation, as explained in Factory reset everything. Be sure to write it down in a safe place just in case.*

Blocking Movie Store, TV Store, and News (U.S. only)

One of the parental control options is to completely hide the entertainment options that are available directly on the Home screen menu.

To hide Home screen entertainment options:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, highlight Home screen and then select or clear either of these options:

   - Hide "Movie Store and TV Store" – Removes the Movie Store and TV Store options from the Home screen menu.

   - Hide "News" – Removes the News option from the Home screen menu.

Tip: *To use either of these options after you've hidden them, you must return to this screen and remove the check mark from the corresponding Hide command.*

Blocking Broadcast TV shows

For broadcast TV, parental controls use information embedded in the broadcast signal to determine whether to allow a program to be displayed. Parents can configure parental controls to block broadcast TV programs that meet or exceed a specific rating, so they cannot be viewed or heard unless the correct parental control PIN is entered.

Note: *Rating standards differ by country.*

Enabling parental control of TV shows

The first step in blocking TV shows is to enable parental control of TV shows.

This setting is provided separately to make it easier for you to turn parental control of TV shows on and off without disturbing their settings. For example, your kids are going to summer camp for two weeks, and while they are gone, you don't want to have to deal with unblocking shows that you want to watch by entering your parental control PIN. All you need to do is clear Enable

parental controls, and all TV shows are unblocked. When the kids return, select Enable parental controls again, and all of your parental control settings are restored in a single operation.

To enable parental control of TV shows:

1. In the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, navigate to TV tuner > Parental control of TV shows.

3. Make sure the check box next to Enable parental controls is checked. If not, highlight it and press OK.

Blocking based on US TV ratings

Most broadcast US TV shows—other than movies—contain rating data that enables parental controls to block shows that parents don't want others to view. The ratings are divided into two groups that function independently:

*   Youth group – TV-Y, TV-Y7
*   Main group – TV-G, TV-PG, TV-14, TV-MA

Within each of these groups, the ratings interact such that if you block a particular level of content, the TV also blocks all content with a higher rating. Conversely, if you unblock a particular level of content, the TV also unblocks all content with a lower rating. For example, if you block TV-PG programs, the TV also blocks TV-14 and TV-MA programs. If you subsequently unblock TV-14 programs, TV-PG programs are also unblocked, but TV-MA programs remain blocked.

Similarly, within the main group, content types can be individually blocked. For example, you can block just coarse language in shows with a TV-PG rating. If you do, then the TV also blocks shows with coarse language in the higher ratings (TV-14 and TV-MA). Subsequently unblocking coarse language in TV-14 ratings does not unblock coarse language in TV-MA programs, but it does unblock coarse language in TV-PG programs.

To block TV shows based on US television ratings:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, navigate to TV tuner > TV ratings. Choose among the following settings:

   - Entire ratings – Highlight the rating you want to block, and then navigate to the right and select the first option that blocks the entire rating level (and all higher rating levels).

   - Individual content types – Highlight the rating that contains the content type you want to block, and then select the content types you want to block from among those listed. Remember that blocking a content type in one rating blocks the equivalent content type in all higher rating levels.

Blocking based on US movie ratings

Most movies in the US are rated by the Motion Picture Association of America, or MPAA, so the ratings are known as MPAA ratings. TV broadcast signals carry movie rating data that enables parental controls to block shows that parents don't want others to see. The ratings are:

- G – General audiences
- PG – Parental guidance suggested
- PG-13 – Parents strongly cautioned for children age 13 or younger
- R – Restricted
- NC-17 – Not for age 17 or younger

Unlike US TV ratings, there are no individual content types within the ratings. But like TV ratings, blocking movies with a particular rating also blocks movies with a higher rating, and unblocking movies with a particular rating also unblocks movies with a lower rating.

Tip: *Blocking movies with an NC-17 rating also blocks programs with the now-obsolete X rating, which can still occur in the program data of older movies.*

To block movies based on MPAA ratings:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, navigate to TV Tuner > Movie ratings.

3. Select the rating level you want to block. You need only select one rating level, and all higher levels are automatically blocked.

Blocking based on Other ratings

Your TV can block programs having ratings that had not been defined when the TV was manufactured. It does this by detecting a new Rating Region Table in a program and then downloading the new table and displaying its rating in the Parental controls.

When the TV downloads a new Rating Region Table, it adds a new option to the list of rating types: Other ratings. If you see this option in the Parental controls screen, you have tuned to a station that has implemented a new rating table. Once the new rating table has been downloaded to the TV, it remains in the TV until it is factory reset, and you can configure blocking based on the new ratings.

New Region Rating Tables can have independent rating levels, or rating levels that interact in the same ways as the built-in US TV and MPAA Movie ratings.

Tip: *If your TV downloads a new Region Rating Table, you'll have to experiment with its settings to understand how to use it.*

Blocking based on Canadian English ratings

Canadian-English language and third-language programs that are broadcast in Canada are rated by the Action Group on Violence on Television, or AGVOT. TV broadcast signals carry rating data that enables parental controls to block shows that parents don't want others to view based on content containing violence, language, sex, or nudity. The ratings are:

- C – Children under 8 years
- C8 – Children 8 years and older
- G – Generally suitable for all age groups
- PG – Parental guidance suggested for viewers under 14 years
- 14+ – Generally not suitable for viewers under 14 years

- 18+ – Generally not suitable for viewers under 18 years

Blocking content with a particular rating also blocks content with a higher rating, and unblocking content with a particular rating also unblocks movies with a lower rating.

To block programs based on AGVOT ratings:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, navigate to TV tuner > Canadian English ratings.

3. Select the rating level you want to block. You need only select one rating level, and all higher levels are automatically blocked.

Blocking based on Canadian French ratings

Canadian-French language programs that are broadcast in Canada are rated by the Régie du cinéma du Québec. TV broadcast signals carry rating data that enables parental controls to block shows that parents don't want others to view based on content containing violence, language, sex, or nudity. The ratings are:

- G – Generally suitable for all age groups
- 8+ – Viewers 8 years and older
- 13+ – Viewers 13 years and older
- 16+ – Viewers 16 years and older
- 18+ – Adults only

Blocking content with a particular rating also blocks content with a higher rating, and unblocking content with a particular rating also unblocks movies with a lower rating.

To block programs based on Canadian-French ratings:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, navigate to TV tuner > Canadian French ratings.

3. Select the rating level you want to block. You need only select one rating level, and all higher levels are automatically blocked.

Blocking unrated programs

Some broadcast TV shows and movies are assigned a rating of "Unrated". Whether or not such programs contain content that is objectionable to you cannot be determined. However, you can choose to block such programs.

To block all unrated broadcasts:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, navigate to TV tuner > Block all unrated programs.

3. Highlight Unrated programs and press OK. When blocking is enabled, the adjacent padlock icon changes from unlocked to locked.

Tip: *Blocking programs that have been assigned a rating of "Unrated" does not block programs that have no rating assigned to them (for example a broadcast of a local town council meeting). Programs that do not have an assigned rating display Rating NA (for "not applicable," meaning a rating is not needed).*

What happens when a TV show is blocked?

After you've set up parental controls, TV shows and movies can be blocked:

- When you change channels and the new channel is playing a program whose rating exceeds your settings.

- When a new show comes on the channel you are watching and its rating exceeds your settings.

When a program is blocked by parental control settings, the TV displays a blocked message:
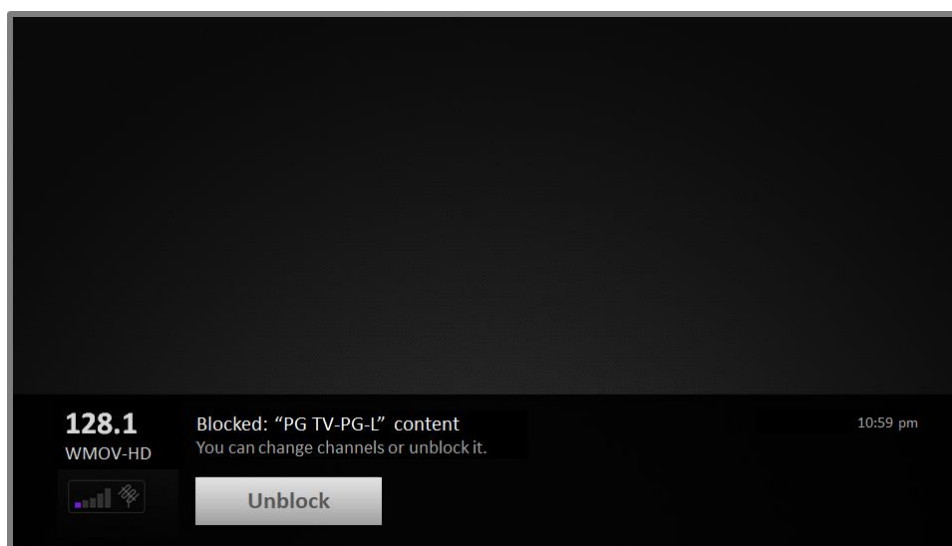
Whenever this blocked message appears, both the video and audio of the show are blocked, as well as program data that would normally appear in the area at the bottom of the screen.

To watch the blocked program, you need to know the PIN code defined when you enabled parental controls, as explained in Creating a parental control PIN.

1. Press OK to select Unblock and display a PIN pad.
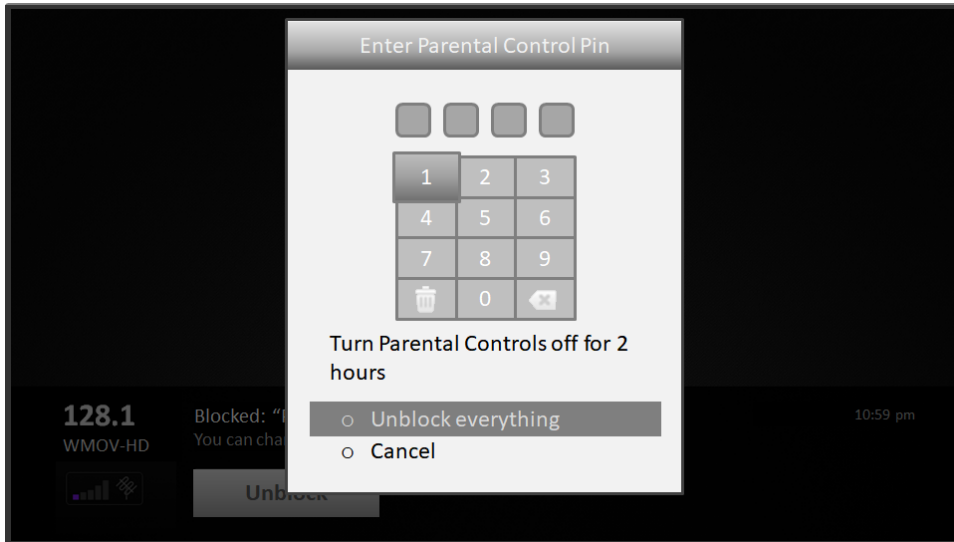
2. Use the arrow keys to enter your parental control PIN code, and then press OK to select Unblock everything.

After unblocking shows that have been blocked, all blocking is disabled for two hours or until you turn off the TV.

Changing the parental control PIN

To change your parental control PIN:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, highlight Change PIN.

3. Move the highlight into the adjacent keypad, and then use the arrow keys and then press OK to enter a four digit code. Then repeat the process to enter the same PIN again, just to make sure you correctly entered the PIN you want to use.

Resetting parental controls

So now your kids have grown up and gone away to college, and you no longer want to deal with blocked programs.

To erase all parental control settings:

1. From the Home screen menu, navigate to Settings > Parental controls, and then enter your parental control PIN.

2. In the Parental controls screen, highlight Reset parental controls.

3. Follow the instructions on the screen to confirm that you want to erase all parental control settings.

   Tip: *Resetting parental controls also erases your parental control PIN.*

More settings

This section describes the features and settings of the TV that were not covered in the other parts of this guide.

Changing network settings

If needed, you can change your network settings at any time. For example, if you change the name of your wireless network (its SSID) or its password, you will need to change your TV's settings so that it can continue to connect. Also, if you decided not to connect to the Internet in Guided Setup, you can use network settings to connect at a later time.

To change network settings, from the Home screen menu, navigate to Settings > Network, and then press the RIGHT arrow. At this point, you can choose the following options:

- About – Lists important information about your current network connection, such as status, connection type, IP addresses, and MAC address. This information is often useful when contacting customer support with connection issues.

- Check connection – Select your existing network connection type, and then press OK to start checking the network connection. The TV uses your current network information to reconfirm the wireless or wired network connection to the local network and the Internet connection.

- Set up connection – Select a network connection type, and then select the option to set up a new connection. Follow the on-screen instructions to complete the network connection. For help with each of the steps, see Network connection.

Note: *Some networks, such as those found in dorm rooms, hotels, and other public places, may require you to read and agree to terms, enter a code, or provide identifying information before letting you connect to the Internet. For more information, see Using your TV in a hotel or dorm room.*

Changing time settings

You can change time settings to suit your preferences. You can find the following settings by navigating from the Home screen menu to Settings > System > Time:

- Sleep timer – Set a time delay after which the TV will automatically shut off. This setting reflects the setting you can make in the Options menu from any TV input, as explained in Options menu settings. *Note that the sleep timer setting is not input specific.*

- Time zone – Select whether to set the time zone automatically or manually, and if set manually, select your current time zone. Typically, a TV connected to the Internet can discover its own time zone automatically, and a TV that is not connected to the Internet must be set manually. Initially, this setting is made when you set up the TV tuner, as explained in Setting up Antenna TV. Correct time zone information is needed to correctly display program data.

- Clock format – Select whether to display time in a 12-hour or 24-hour format, or to turn off time display. *This setting is available only on TVs that are connected to the Internet. Non-connected TVs do not display the time.*

Scanning for Antenna TV channels again

There will be times when you need to create a new channel list. For example, you:

- Change cable providers

- Reorient your TV antenna

- Move to a different city with different channels

Whenever you need to update your TV channel list, you can repeat the channel scan.

Tip: *Repeat the channel scan from time to time to make sure you are receiving all of the latest channels. Broadcasters add and remove channels, move channels to different parts of the spectrum, and change the power levels of their channels periodically.*

Note: *Repeating the tuner channel scan unhides all hidden channels.*

To repeat the channel scan, from the Home screen menu, navigate to Settings > TV inputs > Antenna TV > Scan again for channels. Then select Start finding channels to begin the channel scan process. The screens and options that appear during this process are identical to those described in How do I set up the TV tuner?

Setting the HDMI® mode (4K models only)

On 4K (UHD) TVs, you can independently configure each HDMI® input to match the capabilities of the connected device. From the Home screen menu, navigate to Settings > TV inputs, and then select an enabled HDMI® input. Next, select HDMI mode and then select one of the following settings:

- Auto – Let the TV determine the best setting. Use this option unless your HDMI® device does not correctly communicate its HDMI® version compatibility.

- HDMI 1.4 – Configure the input for compatibility with HDMI® version 1.4, which supports a maximum refresh rate of 30 Hz at full UHD resolution. Most HDMI® devices will work correctly with the TV in this mode.

- HDMI 2.0 – Configure the input for compatibility with HDMI® version 2.0, which supports a maximum refresh rate of 60 Hz at full UHD resolution. You must use this mode to view HDR content from the device connected to this HDMI® input. However, note that many older HDMI® devices do not work correctly when the TV's HDMI® input is set to this mode.

Adjusting external control

You can choose the level of external control you want to allow your TV to accept. External control enables other devices, including the Roku Mobile App, to control your TV over the local area network in your home.

To adjust the level of external control access:

1. From the Home screen menu, navigate to Settings > System > Advanced system settings > External control.

2. Select Network access.

3. Choose one of the following settings:

   • Default – External control is enabled only on a private network address, and accepts commands only from other private network addresses on your home network. This setting is suitable for most cases, including use of the Roku mobile app on your smartphone.

   • Permissive – External control is enabled under all conditions, but accepts commands only from private network addresses or the same subnetwork within your home network. This setting might be required when attempting to operate the TV from a third-party application, for example, one of the Internet of Things (IoT) applications such as ifttt.com.

   • Disabled – External control is completely disabled. The TV does not accept external commands from any source, including the Roku mobile app.

Using the TV in a home theater

Your TV has several features that make it an ideal TV for a home theater. But you might not notice them because they remain in the background until you decide to use them.

Turning off the speakers

When you use your TV with a sound bar or an external amplifier and speakers, you'll probably want to turn off the internal TV speakers.

To turn off the TV's built-in speakers, in the Home screen menu, navigate to Settings > Audio > TV speakers and change the setting.

Tip: *The TV's internal speakers can be enabled and disabled automatically as needed by system audio control, as described in* [Enable system audio control.](#) *Using the headphone jack also turns off the internal speakers.*

Changing the audio mode

The TV has two audio modes, accessed by navigating in the Home screen menu to Settings >Audio > Audio mode:

- Stereo – Use this setting for internal speakers, headphones, and external stereo amplifiers connected through HDMI$^®$ ARC, SPDIF optical, or headphone jack.

- Auto – Use this setting to automatically detect the best audio setting based on the audio stream in the content you are watching. If you have connected the TV to an external Dolby Audio™ compatible amplifier, receiver, or sound bar through HDMI$^®$ ARC or SPDIF optical, the TV automatically selects the appropriate surround sound capabilities of the device based on the characteristics of the current program.

Setting up a digital audio connection

You can connect the TV to an external amplifier, receiver, or sound bar by using either of these two connections:

- HDMI ARC – The HDMI® Audio Return Channel enables the TV to output digital audio on one of its HDMI® connectors. The connected amplifier can also function simultaneously as an input source to the TV, if needed. To use the ARC capability, you must connect an HDMI® cable from your amplifier's HDMI® ARC connector to the HDMI ARC connector on the TV. You also must:

    - Be sure your HDMI® cable is certified by HDMI®.

    - Enable HDMI ARC under Settings > System > Control other devices (CEC), as explained in Enable HDMI® ARC.

- SPDIF optical – The TV has an SPDIF optical connector that outputs a digital audio signal. To use the optical output, connect a TOSLINK optical cable from the amplifier to the Optical or SPDIF connector on the TV.

    Note: *Dolby Audio™ supporting Dolby Digital Plus™ format is not available through the SPDIF optical output. This format is only available through the HDMI® ARC connection.*

After making the required HDMI® ARC or SPDIF optical connection, go to Settings > Audio > S/PDIF and ARC option and select the audio format to use.

Note: *In most cases, Auto detect is the best option. Other settings can result in no sound when the content you are viewing does not contain the audio stream type you selected.*

Controlling other devices through CEC

Consumer Electronics Control (CEC) enables your TV and other CEC-compatible home entertainment devices to control one another in various ways. First, the CEC-compatible devices must "discover" one another and report their capabilities. After this, one device can control another according to the features you enable. For example, playing a disc on a Blu-ray™ player could switch the TV to the Blu-ray™ player's input. Or, powering off the TV could also power off the Blu-ray™ player and the home theater receiver.

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Discover connected CEC devices

To discover CEC devices:

1. Make sure that your CEC-compatible devices are connected to the TV with a suitable High Speed HDMI® Cable that supports HDMI® ARC and CEC control.

2. Turn on each device and make sure all devices are CEC enabled.

   Tip: *Some manufacturers have their own branded names for CEC functionality, so you might need to read the product documentation to correctly identify the CEC features of the device.*

3. On the TV's Home screen menu, navigate to Settings > System > Control other devices (CEC) and then select Search for CEC devices. Press OK to repeat the discovery process, if necessary.

When finished, the TV displays a list of CEC devices that are connected to each HDMI® input, as well as any devices that had previously been connected. The TV remembers the names of multiple CEC devices even when they are no longer connected. If the list is longer than the allowed space, press ✱ to see a complete list in a scrollable window.

Enable HDMI® ARC

HDMI® ARC is the audio return channel that is available on one of the TV's HDMI® ports. The audio return channel enables you to send a Dolby Audio™ signal back to a home theater receiver that is also sending an audio and video signal into the TV. Using HDMI® ARC reduces the number of cables needed and optionally lets you control the volume and mute state of the receiver by enabling system audio control.

HDMI® ARC is disabled by default. To enable HDMI® ARC, in the Home screen menu, navigate to Settings > System > Control other devices (CEC), and then highlight HDMI ARC. Press OK to enable or disable the feature.

Note: *Enabling HDMI ARC also enables System audio control. After enabling HDMI ARC, you can disable System audio control if you prefer.*

Enable system audio control

System audio control enables the TV remote to change the volume and mute state of an amplifier or sound bar connected through HDMI®, and to display the external device's volume and mute status in the TV's on-screen display.

The TV automatically turns off its internal speakers and sends volume and mute control signals to an external amplifier when all of the following are true:

- System audio control is enabled on the TV.

- The TV is connected to a CEC-compatible amplifier, it is powered on, and CEC discoverability is enabled.

- The CEC-compatible amplifier's HDMI® ARC connector is connected to the TV's HDMI ARC connector with a suitable HDMI® cable.

When the CEC-compatible amplifier is off, the TV automatically turns on its speakers (unless you have turned them off as described in Turning off the speakers) and resumes local control of volume and mute state.

To enable or disable system audio control, in the Home screen menu, navigate to Settings > System > Control other devices (CEC) and highlight System audio control. Press OK to enable or disable the feature.

Enable 1-touch play

1-touch play enables a device to control which TV input is active. For example, pressing Play on your Blu-ray™ player switches the TV to the Blu-ray™ input.

1-touch play is disabled by default. To enable 1-touch play, in the Home screen menu, navigate to Settings > System > Control other devices (CEC) and highlight 1-touch play. Press OK to enable or disable the feature.

Enable system standby

The system standby feature causes other devices to power off when you power off your TV. Depending on the CEC System Standby implementation, it also might enable connected devices to power off your TV when you power off the device.

System standby is disabled by default. To enable system standby, in the Home screen menu, navigate to Settings > System > Control other devices (CEC) and highlight System standby. Press OK to enable or disable the feature.

Restarting the TV

You can restart the TV when necessary. Restarting has the same effect as unplugging the TV power and then plugging it in again.

To restart the TV, navigate to Settings > System > Power, and then select System restart. Highlight Restart, and then press OK to confirm restart.

While the TV restarts, the screen goes dark for a few seconds, and then displays the startup screen for a few more seconds. When the restart operation completes, the TV displays the activity you selected in Power on settings.

Resetting the TV

You can choose to reset only the TV picture and audio settings to their original values, or perform a full factory reset to return the TV to the state it was in when you first unpacked and turned it on.

Reset audio/video settings

To reset only the TV picture and audio settings to their original values, navigate to Settings > System > Advanced system settings > Factory reset, and then highlight Reset TV audio/video settings. Read the information on the screen to make sure you understand what the reset operation does.

To proceed with the reset operation, press PLAY/PAUSE three times in a row.

Factory reset everything

A full factory reset returns the TV's settings to their original state and removes all personally identifiable information from the TV. When finished, you must repeat Guided Setup,

reconnecting to the Internet, re-linking your Roku account, and reloading any streaming channels. You also must repeat Antenna TV setup and input configuration.

Factory reset is the recommended choice if you want to transfer the TV to another owner, and it is the only choice if you want to switch from Store mode to Home mode (if you inadvertently selected Store mode during Guided Setup).

To perform a factory reset, navigate to Settings > System > Advanced system settings > Factory reset, and then highlight Factory reset everything. Read the information on the screen to make sure you understand what this reset operation does.

To proceed with the full factory reset, use the on-screen number pad to enter the code displayed on the screen, and then select OK to proceed.

When the factory reset operation completes, the TV restarts and displays the first Guided Setup screen.

What if I can't access the Factory Reset option?

It is possible for your TV to get into a state where you cannot access the various menus, including the menu option that lets you perform a factory reset operation. If that happens, you can force the TV to reset by following these steps.

Models with a RESET button

1. Using a straightened paper clip or ball-point pen, press and hold the recessed RESET button on the TV connector panel.

2. Continue to hold the RESET button for approximately 12 seconds.

   When the reset cycle completes, the status indicator comes on dim.

3. Release the RESET button. The TV is now powered off.

4. Turn on the TV and proceed through Guided Setup. See Guided Setup.

Models without a RESET button

1. On the TV panel (not the remote) press and hold down the MUTE and POWER buttons.

2. Unplug the TV power, and then plug it in while continuing to hold down the MUTE and POWER buttons.

3. When you see the startup screen appear on the TV, release the buttons.

4. Turn on the TV and proceed through Guided Setup. See [Guided Setup](#).

Network connection reset

If you want to remove your network connection information without disturbing other settings, navigate from the Home screen to Settings > System > Advanced systems settings > Network connection reset, and then select Reset connection.

When you select this option, the TV removes your wireless network information, including the name of the connection (its SSID) and your wireless password, if any, and then it restarts. After restarting, your TV retains all of its other settings and its association with your Roku account.

After resetting your network connection, navigate from the Home screen to Settings > Network > Set up new connection to continue enjoying all of the benefits of your connected TV.

Changing your Roku Channel Store PIN preference

When you created your Roku account, you were given the opportunity to create a PIN code and to specify when it must be used. If you created a Channel Store PIN and want to change it, or you don't remember your PIN, or if you didn't create a Channel Store +PIN and want to add one, you can easily make these changes.

1. On a computer, tablet, or smartphone, use your web browser to go to https://my.roku.com and sign in.

    After signing in, the My Account page appears.

2. Under PIN Preference, click Update to open the Choose Your PIN Preferences page.

3. Skip this step if you just want to change your PIN. Otherwise, choose the option your prefer from among those listed:

    - Require a PIN to make purchases or to add any item from the Channel Store.

- Require a PIN to make purchases.

- Do not require a PIN to make purchases.

4. If you choose either of the first two options, enter your PIN twice in the appropriate boxes.

5. Click Save Changes to save your changes and return to the My Account page. Note that your current setting is described under PIN Preference.

Getting system updates

If your TV is operating in connected mode, it will automatically get updates from time to time. You don't need to do anything. But if you are aware that an update is available and you don't want to wait until the TV updates itself, you can manually check for updates.

If your TV is operating in non-connected mode, you can still get updates by using a USB flash drive.

You can download an updated User Guide that matches your Roku TV software version from the Roku web site at:

www.roku.com/support

To determine your current Roku TV software version, go to Settings > System > About, and then press OK or navigate to the right.

Checking for updates on a connected TV

If you're one of those people who has to have the latest, most up-to-date features the moment they are available, you can check for updates as often as you want.

To check for updates, navigate to Settings > System > System update, and then select Check now. The TV responds either with a message saying that your TV is up to date, or with a message saying that an update is available.

Follow the instructions on the screen to install the system update.

Note: *Sometimes system updates install new system software, and other times they install new features for streaming channels. Therefore, you won't always see a change in the behavior of your TV after a system update.*

Getting updates on a non-connected TV

If your TV is not connected to the Internet, you can still get system updates by using a USB flash drive and a computer with an Internet connection.

To get a system update, navigate to Settings > System > System update:
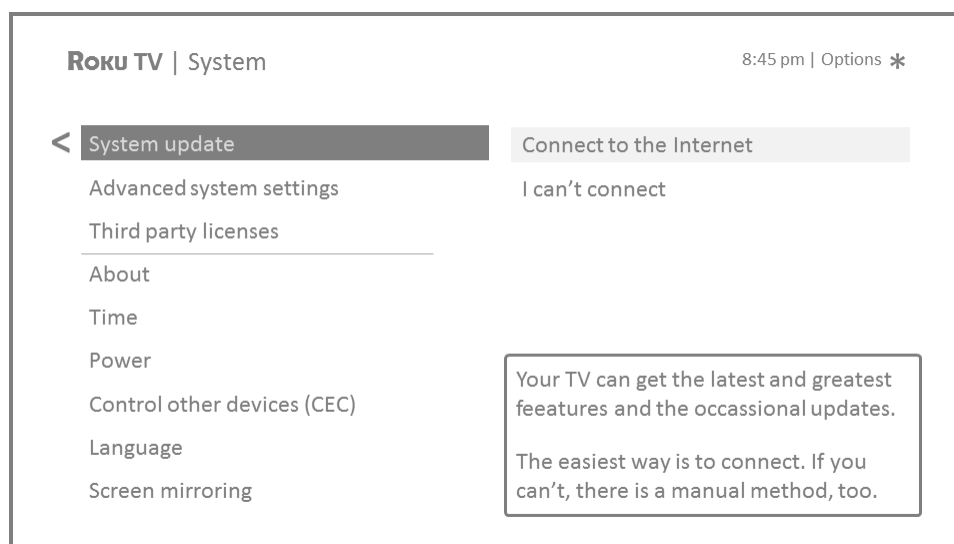
The System update screen on a non-connected TV gives you the opportunity to connect your TV to the Internet to automatically receive updates. We recommend this option if it is possible in your situation. To proceed, select Connect to the Internet and follow the instructions in What if I didn't connect my TV?.

Otherwise, if you can't connect to the Internet, select I can't connect, and then follow the instructions on the screen. Here's a summary:

1. On an Internet-connected computer, go to the web site displayed on the System update screen.

2. On the USB Update web page, select the correct brand and model, and then click Next.

3. Click Download Software, and then save the file to the root folder of a standard USB flash drive.

USB flash drive

Any normal USB flash drive will work, provided it has a FAT-16 or FAT-32 file system format. (This is the default for most flash drives.)

The size of the download is small—usually less than 100 MB—and so will fit on most any size flash drive you might have.

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4. When the download finishes, take the USB flash drive to the TV and plug it into the USB port. When you do, the TV validates the files on the flash drive and displays a 12-digit code.

5. Write down the code and the web address, and take this information back to your Internet-connected computer.

6. On the 12-digit code page, enter the code your TV displayed, and then click Next.

7. On the 6-digit code page, write down the 6-digit code that appears, and then take it back to your TV.

12- and 6-digit codes

The USB update process uses a pair of codes to validate that you are authorized to install an update, and to ensure you are not attempting to install an old, unsupported version of the system software.

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8. Using the TV remote, select Next to move to the next screen, and then use the on-screen keyboard to enter the 6-digit code. When finished, select OK. The system update begins. Do not remove the USB flash drive until the TV restarts.

When the update finishes, the TV restarts. You can check the new version number by navigating to Settings > System > About.

Other devices

Screen Mirroring your phone or tablet

Only in connected mode, your TV has a feature called screen mirroring that lets you mirror your compatible smartphone or tablet on your TV. Share videos, photos, web pages, and more from compatible devices.

By default, your TV's screen mirroring mode is set to Prompt. In this mode, when your TV receives a screen mirroring request, it prompts you with the following options, unless you have previously selected Always accept or Always ignore for the device:

- Always accept – Always accept mirrored content from the mobile device without additional prompting in the future for this device.

- Accept – Accept mirrored content from the mobile device this time only. Prompt again next time this device attempts to mirror content.

- Ignore – Do not accept mirrored content from the mobile device at this time. Prompt again next time this device attempts to mirror content.

- Always ignore – Never accept mirrored content from this mobile device.

Note: *You can manage and change the list of devices that are set to Always accept or Always ignore by navigating from the Home screen to Settings > System > Screen mirroring > Screen mirroring devices.*

- If you prefer to always allow all screen mirroring attempts without prompting, go to Settings > System > Screen mirroring, and then change the Screen mirroring mode to Always allow.

- If you prefer to never allow screen mirroring from any device, change the Screen mirroring mode to Never allow.

For information on which devices may work with screen mirroring and instructions on how to use it, go to the following link on the Roku web site:

go.roku.com/screenmirroring

Getting and using the Roku mobile app

Roku makes the Roku mobile app free for compatible iOS® and Android™ mobile devices.

The Roku mobile app is an alternative remote for your Roku TV. The Roku mobile app helps you find and add new Roku Channels, more easily search and find something to watch and, *only in the United States*, even use your voice to search without typing.

Find more information and get the Roku mobile app by using the following link to the Roku web site:

go.roku.com/mobileapp

Private Listening on the Roku mobile app

Only on compatible Apple and Android devices, the Roku mobile app enables you to use headphones connected to your device to listen to streaming programs Antenna TV channels. Make sure you have the latest version of the Roku mobile app before using this feature.

For more information, go to the following link on the Roku web site:

go.roku.com/privatelistening

Using a universal remote

In many cases, you can program your cable or satellite universal remote to also control your TV. You will need to have instructions for programming the remote handy. Check with your cable or satellite provider for instructions.

For details on how to set up the TV to work with universal remotes, go to the following link on the Roku web site:

go.roku.com/universalremote

FAQ

For the latest answers to Frequently Asked Questions, visit the Roku support website:

go.roku.com/support

Legal statement

Please note—Use of the Roku TV is governed by the Roku TV End User Agreement (see below). In addition, an end user online profile and billing account with Roku, Inc. ("Roku") on Roku's website ("Roku Account") is required to stream content via the Internet using your Roku TV. A Roku Account gives you access to movies, television shows, and other audio-visual entertainment in the "Roku Channel Store," a storefront of applications provided by Roku via your device's on-screen menu. After your Roku Account is created, you can link your Roku TV to your account. By using the Roku TV, you agree to the following disclaimer. For the avoidance of doubt, the content disclaimer set forth herein shall refer to all content and channels accessible and available on the Roku TV, including those available via the Roku® streaming platform, as well as broadcast cable.

Due to the various capabilities of the Roku TV, as well as limitations in the available content available therein, certain features, applications, and services may not be available on all Roku TV s, or in all territories. Some features on the Roku TV may also require additional peripheral devices or membership fees that are sold separately. Please visit the Roku, Inc. website for more information on the Roku TV and content availability. The services and availability of content on the Roku TV are subject to change from time to time without prior notice.

All content and services accessible through the Roku TV belong to third parties and are protected by copyright, patent, trademark and/or other intellectual property laws. Such content and services are provided solely for your personal noncommercial use. You may not use any content or services in a manner that has not been authorized by the content owner or service provider. Without limiting the foregoing, you may not modify, copy, republish, upload, post, transmit, translate, sell, create derivative works, exploit, or distribute in any manner or medium any content or services displayed through the Roku TV.

You expressly acknowledge and agree that your use of the Roku TV is at your sole risk and that the entire risk as to satisfactory quality, performance and accuracy is with you. The Roku TV and all third party content and services are provided "as is" without warranty of any kind, either express or implied. Roku expressly disclaims all warranties and conditions with respect to the Roku TV content and services, either express or, implied, including but not limited to, warranties of merchantability, of satisfactory quality, fitness for a particular purpose, of accuracy, of quiet enjoyment, and non-infringement of third party rights. Roku does not guarantee the accuracy, validity, timeliness, legality, or completeness of any content or service made available through the Roku TV and does not warrant that the Roku TV, content or services will meet your requirements, or that operation of the Roku TV will be uninterrupted or error-free. Under no circumstances, including negligence, shall Roku be liable, whether in contract or tort, for any direct, indirect, incidental, special or consequential damages, attorney fees, expenses, or any other damages arising out of, or in connection with, any information contained in, or as a result of the use of the device, or any content or service accessed by you or any third party, even if advised of the possibility of such damages.

Third party services may be changed, suspended, removed, terminated or interrupted, or access may be disabled at any time, without notice, and Roku makes no representation or warranty that any content or service will remain available for any period of time. Content and services are transmitted by third parties by means of networks and transmission facilities over which Roku has no control. Without limiting the generality of this disclaimer, Roku expressly disclaims any responsibility or liability for any change, interruption, disabling, removal of or suspension of any content or service made available through the Roku TV. Roku, the content providers, or the service providers may impose limits on the use of or access to certain services or content, in any case and without notice or liability. Any questions or requests for service relating to the content or services made available on the Roku TV should be submitted to the respective cable content or service provider or as described in the Roku TV User Guide.

In the event of a conflict between the Roku TV End User Agreement and the terms set forth in this Legal Disclaimer, the Roku TV End User Agreement shall prevail and control in all circumstances.

END USER LICENSE AGREEMENT (FOR ROKU TV)

IMPORTANT: READ THIS AGREEMENT CAREFULLY BEFORE YOU USE A ROKU TV. ALSO REVIEW THE

IMPORTANT PRODUCT INFORMATION THAT MAY HAVE BEEN PROVIDED WITH YOUR ROKU TV.

Overview

This End User License Agreement ("EULA") between you and Roku, Inc. ("Roku") governs the use of: (a) your television which uses the Roku platform to play digital content over the Internet ("Television"), and (b) any firmware and software that have been pre-installed on the Television and the firmware and software updates Roku provides to you for the Television (collectively, the "Software"). By linking the Television to your account on Roku's website ("Roku Account") or using the Television, you are agreeing to this EULA. If you are a resident of the European Economic Area, by agreeing to this EULA, you expressly agree to waive your right to withdraw.

If you do not agree to this EULA, you do not have the right to use the Television or the Software. If you are within the allowable time period for returns under the applicable return policy, you may return the Television to your seller for a refund, subject to the terms of such return policy. You should perform a factory reset before you return it to erase data that may be stored on the Television. For instructions on how to reset your Television, please visit www.roku.com/support.

In this EULA, "Channel" means an application in the Roku Channel Store; "Content" means movies, television shows, music and other audio and visual materials and entertainment; "Content Provider" means any provider of Content; and "Roku Channel Store" means the storefront of applications provided by Roku via the Television's on-screen menu.

Changes to This EULA

Roku may amend this EULA at any time in its discretion. Such amendments shall be effective immediately upon posting of the amended EULA on Roku's website or via the Television or your Roku Account, whichever occurs first. If you have a Roku Account that is linked to your Television, then in its option, Roku may also notify you of the amended EULA by sending a notice to the last email address you have provided to Roku. You agree to provide accurate and complete information if and when you set up your Roku Account, and you agree to promptly update your account information (including contact information) to keep it accurate and complete. You can do this at any time by signing in to your Roku Account. Following such posting or notice by any of the methods described above, continued use of your Television or Roku Account means you accept and agree to the amended EULA. If you do not agree to the amended EULA, Roku may not be able to provide updates, upgrades or enhancements to your Television, and you may not be able to continue using your Television or Roku Account.

Permitted Use and Restrictions

The Television and the Software are for personal, non-commercial use only. Copying or redistribution of any Content delivered via the Television is strictly prohibited and we may prevent or restrict you from copying or re-distributing any elements of the Software or Content using digital rights management or other technologies. The Television and the Software are for use only in those countries where the manufacturer of your Television has authorized its sale. If you are using the Television and the Software outside of these countries, the rights granted under this EULA do not apply. Some of the Content Providers use technologies to verify your geographic location, and you may not be able to use the Television or the Software to access any Content outside of the country or location authorized by Roku or the Content Provider. Except as expressly provided under this EULA, you do not acquire any intellectual property or other proprietary rights in or to the Television, the Software or the Content, including any rights in patents, inventions, improvements, designs, trademarks, database rights or copyrights, nor do you acquire any rights in any confidential information or trade-secrets. All rights not expressly granted to you in this EULA are reserved by Roku or its applicable licensors. You may not remove, obscure, alter or conceal any trademark, logo, copyright or other proprietary notice in or on any Television, Software or Content.

The Software is proprietary to Roku or its third party licensors and may be used only with the Television. Subject to this EULA and, where appropriate, the applicable third party licenses, you have a non-exclusive, non-transferable license to run the Software and any updated versions provided to you by Roku, only in and as incorporated in the Television. This is a license and not a sale. You may not (a) copy, assign, sublicense, lease, sell or rent the Software, (b) distribute or otherwise transfer the Software except as incorporated in the Television, provided that, you do not retain any copies of the Software and the recipient reads and agrees to this EULA (including all amendments); (c) modify, adapt, translate, or create derivative works of the Software (except only to the extent any of the foregoing restriction is prohibited by applicable law or as may be permitted by the license terms governing any Separately Licensed Code included with the Software); (d) decompile, disassemble, reverse engineer or otherwise derive source code from the Software, except to the extent such actions cannot be prohibited under applicable law because they are essential to achieve inter-operability of the Software with another software program, and provided that the information obtained by you during such activities is (i) used only to achieve such inter-operability; (ii) not disclosed without Roku's prior written consent; and (iii) not used to create any software that is substantially similar to the Software; (e) defeat, bypass, circumvent or interfere with any security mechanism or access control measures, or (f) have any of the foregoing done for you by a third party. This license does not include the right to receive Software upgrades or updates. Your right to use the Television and the Software will immediately terminate upon your breach of this EULA.

Software Updates

IN ITS SOLE DISCRETION, ROKU MAY PROVIDE UPDATES TO YOUR TELEVISION VIA THE INTERNET, INCLUDING BUG FIXES AND UPDATES, CHANGES IN THE USER INTERFACE OR HOW YOU ACCESS CONTENT, AND OTHER CHANGES THAT MAY ADD, ALTER OR REMOVE FUNCTIONALITIES AND FEATURES. YOU ACKNOWLEDGE THAT THESE UPDATES: (A) MAY HAPPEN AUTOMATICALLY IN THE BACKGROUND AT ANY TIME (AND THAT THEY CANNOT BE DISABLED BY YOU); AND (B) WILL REQUIRE AN INTERNET CONNECTION AND YOU MAY INCUR ADDITIONAL DATA CHARGES FROM THE PROVIDER OF THE INTERNECT CONNECTION. YOU UNDERSTAND THAT THESE UPDATES ARE NECESSARY TO MAINTAIN COMPATIBILITY WITH OTHER UPDATES TO ROKU'S PRODUCTS OR SERVICES AND MAY BE REQUIRED FOR SECURITY REASONS. BY USING THE TELEVISION, YOU HEREBY AGREE TO RECEIVE SUCH UPDATES.

Separately Licensed Code

Certain software components of the Software are provided under separate third party license terms ("Separately Licensed Code") and your right to use such components is governed by such license terms. Please visit go.roku.com/seperatelylicensedcode for more information.

Voice Search

If downloaded to your phone or mobile device, the Roku mobile app allows you to use your voice to search for content on your Television using voice search. When you choose to use voice search, you agree that Roku and/or a third party vendor contracted by Roku have your consent to record, process and store your voice inputs (e.g., a recording and the interpretation of what was said), and use such voice inputs with other information about your Television (e.g., device identifier) to provide services related to voice search to you, to improve the accuracy and quality of the service, and as described in Roku's Privacy Policy. To learn more about voice search, visit the FAQ pages of Roku's website at www.roku.com/support.

NO WARRANTY FROM ROKU; Limitation of LIABILITY

YOUR warranty with respect to the Television is provided by THE TELEVISION'S MANUFACTURER, and not by Roku. ROKU OFFERS NO WARRANTY TO YOU UNDER THIS EULA. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING DISCLAIMER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW:

(A)   THE SEPARATELY LICENSED CODE AND THE SOFTWARE ARE PROVIDED "AS IS", WITH ALL FAULTS AND WITHOUT WARRANTY OF ANY KIND. ROKU DISCLAIMS ALL OTHER WARRANTIES AND CONDITIONS, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY, SATISFACTORY QUALITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT. ROKU DOES NOT GUARANTEE, REPRESENT, OR WARRANT THAT THE TELEVISION, THE SEPARATELY LICENSED CODE AND THE SOFTWARE WILL BE: (I) SECURE, VIRUS-FREE OR ERROR-FREE, OR (II) FREE FROM ATTACK OR SECURITY INTRUSION.

(B)   IN NO EVENT SHALL ROKU, ITS DIRECTORS, OFFICERS OR EMPLOYEES BE LIABLE TO YOU FOR PERSONAL INJURY OR PROPERTY DAMAGE, OR ANY SPECIAL, INCIDENTAL, EXEMPLARY, PUNITIVE, INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING OUT OF ANY TELEVISION, THE SEPARATELY LICENSED CODE, THE SOFTWARE, OR YOUR USE THEREOF; AND

(C)   YOU AGREE THAT (I) THE TOTAL CUMULATIVE LIABILITY OF ROKU, ITS DIRECTORS, OFFICERS AND EMPLOYEES UNDER THIS EULA, INCLUDING LIABIILTY RELATING TO ALL TELEVISIONS LINKED TO YOUR ROKU ACCOUNT, AND THE SEPARATELY LICENSED CODE AND THE SOFTWARE IN SUCH TELEVISIONS, AND YOUR USE THEREOF, SHALL NOT EXCEED THE AMOUNT SET FORTH IN THE ROKU ACCOUNT TERMS AND CONDITIONS YOU AGREED TO FOR YOUR ROKU ACCOUNT, AND (II) ROKU, ITS DIRECTORS, OFFICERS AND EMPLOYEES SHALL NOT BE LIABLE TO YOU UNDER THIS EULA FOR ANY DIRECT DAMAGES ARISING OUT OF, OR IN CONNECTION WITH THE TELEVISION. THE FOREGOING LIMITATIONS SHALL APPLY EVEN IF THE REMEDY PROVIDED HEREIN FAILS ITS ESSENTIAL PURPOSE AND EVEN IF ROKU, ITS DIRECTORS, OFFICERS OR EMPLOYEES HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH LIABILITY.

SOME JURISDICTIONS DO NOT ALLOW EXCLUSIONS OF CERTAIN WARRANTIES OR LIMITATOINS OF LIABILITY FOR CERTAIN TYPES OF DAMAGES, SO SOME OF THE ABOVE LIMITATIONS IN THIS SECTION MAY NOT APPLY TO YOU. NOTHING IN THESE TERMS OF USE SHALL AFFECT ANY NON-WAIVABLE STATUTORY RIGHTS THAT APPLY TO YOU, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM JURISDICTION TO JURISDICTION.

Export Controls

You agree not to download any Content or Software, nor otherwise export or re-export any Television or the Software into (or to a national or resident of) Cuba, Iraq, Libya, North Korea, Iran, Syria or any other country as to which the United States or your country has embargoed goods, or to anyone on the U.S. Treasury Department's List of Specially Designated Nationals or the U.S. Commerce Department's Table of Denial Orders or on similar restricted lists published by your government from time to time. By using any Television or the Software, you are representing and warranting that you are not located in, under the control of, or a national or resident of any such country or on any such list.

Choice of Law; Dispute Resolution

A.   If you are a consumer and a resident in any country in the European Economic Area where the sale of the Television is expressly authorized by its manufacturer, this EULA does not apply to you.

B.   In all other cases, including if you are a resident of the United States (and its possessions and territories) or Canada, you agree that this EULA shall be governed by the laws of the State of California without regard to any conflict of laws principles that may provide the application of the law of another jurisdiction; and:

1.   You and Roku agree to be bound by the procedures set forth below to resolve any and all claims between you and Roku arising out of or relating to any aspect of this EULA, whether based in contract, tort, statute, fraud, misrepresentation or any other legal theory, including but not limited to, claims between you and Roku related to the Television and the Software. Each such claim is referred to individually as "Claim" and collectively as "Claims".

2.   You and Roku agree that, except for THE claims identified in paragraph 4 of this section below, any and all CLAIMS BETWEEN YOU AND ROKU shall be finally settled by binding arbitration. The arbitration shall take place in Santa Clara County, California and shall be administered by the American Arbitration Association ("AAA") pursuant to the AAA's then-current rules, including (if applicable) the AAA's Supplementary Procedures for Consumer-Related Disputes. Please be aware there is no judge or jury in arbitration. Arbitration procedures are simpler and more limited than the rules applicable in court, and review of the arbitrator's decision by a court is limited. YOU AND ROKU FURTHER AGREE THAT EACH OF YOU MAY BRING CLAIMS AGAINST THE OTHER ONLY ON AN INDIVIDUAL BASIS AND NOT AS A PLAINTIFF OR CLASS MEMBER IN ANY PURPORTED CLASS OR REPRESENTATIVE ACTION OR PROCEEDING. The arbitrator may not consolidate or join more than one person's claim and may not preside over any consolidated, representative or class proceeding. Also, the arbitrator may award relief (including monetary, injunctive or declaratory relief) only on an individual basis and may not award any form of consolidated, representative or class-wide relief. Notwithstanding any provision in these terms to the contrary, if the class-action waiver in this provision is deemed invalid or unenforceable, or if an arbitration is allowed to proceed on a class basis, then neither you nor Roku are entitled to arbitrate the Claims. This arbitration provision is subject to the Federal Arbitration Act. The arbitrator's award shall be binding on you and Roku, and may be entered in any court of competent jurisdiction.

3.   Information on AAA and how arbitration is initiated can be found at www.adr.org or by calling 800-778-7879. For Claims between You and Roku of $75,000 or less, you will be responsible for the initial arbitration filing fee, up to the amount of the initial filing fee if you were to initiate a lawsuit against Roku based on such Claims in court. If the arbitrator finds such Claims to be non-frivolous, Roku will pay any difference in such filing fees plus the arbitrator fees. For Claims between You and Roku in excess of $75,000, if you are able to demonstrate that the costs of arbitration will be prohibitive as compared to the costs of litigation, Roku will pay as much of your actual filing fees and the arbitrator fees for the arbitration as the arbitrator deems necessary to prevent the arbitration from being cost-prohibitive as compared to the cost of litigation.

4.   This agreement to arbitrate does not apply to any Claim (a) in which a party is attempting to protect its intellectual property rights (such as its patent, copyright, trademark, trade secret, or moral rights, but not including its privacy or publicity rights), or (b) that may be brought in small-claims court.

5.   If the agreement to arbitrate in this provision is found to be invalid, unenforceable or inapplicable to a given Claim between You and Roku, then any and all proceedings to resolve such Claim must be brought exclusively in a federal court of competent jurisdiction in the Northern District of California or in a state court in Santa Clara County, California. You hereby irrevocably consent to the exclusive jurisdiction and venue of such courts.

6.   30-Day Right to Opt Out: You have the right to opt out of this agreement to arbitrate by sending a written notice of your decision to opt out to the following address: Legal Department, Roku, Inc., 150 Winchester Circle, Los Gatos, CA 95032, USA; provided that, such notice must be postmarked on or before the 30th day after the first to occur of the following events if you do not already have a Roku Account: (a) the date of purchase of Your Television, or (b) the date you create your Roku Account. If you have an existing Roku Account, all devices you choose to link to your Roku Account, and all services provided by Roku which are accessed using these devices, will be subject to this agreement to arbitrate. Your notice should include your full name, your current postal address, telephone number and email address, the product name and serial number for Your Television, and a copy of the original proof of purchase for your Television. If you timely send a notice in compliance with this paragraph 6, the agreement to arbitrate will not apply to either you or Roku. If you do not timely send this notice, then you agree to be bound by this agreement to arbitrate.

7.   Notwithstanding any provision in this Agreement to the contrary, you agree that, if Roku seeks to delete or materially modify the agreement to arbitrate described herein, any such deletion or modification will not apply to any individual Claim of which you have notified Roku prior to such modification.

Miscellaneous

Roku may transfer its rights and obligations under this EULA to another organization. You may only transfer your rights or your obligations under this EULA to another person if Roku agrees in writing. This EULA is between you and Roku. No other person shall have any rights to enforce these terms. Each of the paragraphs of this EULA operates separately. If any court or relevant authority decides that any of them are unlawful, the remaining paragraphs will remain in full force and effect. If Roku fails to insist that you perform any of your obligations under this EULA, or if Roku does not enforce its rights against you, or if Roku delays in doing so, that will not mean that Roku has waived its rights against you, or that you do not have to comply with those obligations. If Roku does waive a default by you, Roku will only do so in writing, but that will not mean that Roku will automatically waive any later default by you.

Contact Information

If you wish to contact Roku, please send your correspondence by mail to Roku, Inc., 150 Winchester Circle, Los Gatos, CA 95032 USA, or by email to customerservice@roku.com.

Last Updated: April 21, 2016

CONTRAT DE LICENCE D'UTILISATEUR FINAL (POUR ROKU TV)

IMPORTANT : LIRE ATTENTIVEMENT CE CONTRAT AVANT D'UTILISER UN TÉLÉVISEUR ROKU TV. PASSER ÉGALEMENT EN REVUE LES RENSEIGNEMENTS IMPORTANTS RELATIFS AU PRODUIT QUI PEUVENT AVOIR ÉTÉ FOURNIS AVEC VOTRE TÉLÉVISEUR ROKU TV.

Aperçu

Le présent contrat de licence d'utilisateur final (« CLUF ») conclu entre vous et Roku, Inc. (« Roku ») régit l'utilisation de : (a) votre téléviseur qui se sert de la plateforme Roku pour lire du contenu numérique sur Internet (« Téléviseur ») et (b) tous les microprogrammes et logiciels qui ont été préinstallés sur le Téléviseur, ainsi que les mises à jour des microprogrammes et logiciels que Roku met à votre disposition pour le Téléviseur (collectivement le « Logiciel »). Lier le Téléviseur à votre compte sur le site Web de Roku (« Compte Roku ») ou utiliser le Téléviseur signifie que vous acceptez ce CLUF. Si vous résidez sur le territoire économique européen et acceptez ce CLUF, vous acceptez expressément de renoncer à votre droit de rétractation.

Si vous n'acceptez pas le présent CLUF, vous ne pouvez pas utiliser le Téléviseur ni le Logiciel. Si le délai autorisé pour les retours n'est toujours pas échu en vertu de la politique de retour applicable, vous pouvez retourner le Téléviseur à votre vendeur pour obtenir un remboursement, sous réserve des modalités d'une telle politique de retour. Vous devez effectuer une réinitialisation d'usine avant de retourner l'appareil afin d'effacer les données pouvant être stockées sur le Téléviseur. Pour obtenir des renseignements sur la façon de réinitialiser votre Téléviseur, veuillez visiter la page www.roku.com/support.

Dans le présent CLUF, « Canal » désigne une application de la boutique de canaux Roku; « Contenu » désigne des films, des séries télévisées, de la musique et tout autre contenu et divertissement audiovisuel; « Fournisseur de contenu » désigne tout fournisseur de Contenu et « Boutique de canaux Roku » désigne la vitrine d'applications fournies par Roku par l'intermédiaire du menu à l'écran du Téléviseur.

Modifications au présent CLUF

Roku peut modifier ce CLUF à tout moment à sa discrétion. Ces modifications entreront en vigueur immédiatement après la publication du CLUF modifié sur le site Web de Roku, le Téléviseur ou votre compte Roku, selon la première éventualité. Si vous disposez d'un compte Roku associé à votre Téléviseur, Roku peut également, à sa discrétion, vous informer du CLUF modifié en envoyant un avis à la dernière adresse électronique que vous avez indiqué à Roku. Vous acceptez de fournir des renseignements exacts et complets lorsque vous configurez votre compte Roku et vous vous engagez à mettre rapidement à jour les renseignements de votre compte, y compris vos coordonnées, afin qu'ils soient exacts et complets. Vous pouvez le faire à tout moment en vous connectant à votre compte Roku. À la suite d'une telle annonce ou d'un tel avis par l'une des méthodes décrites ci-dessus, continuer à utiliser votre Téléviseur ou votre compte Roku signifie que vous acceptez le CLUF modifié. Si vous n'acceptez pas le CLUF modifié, Roku ne sera peut-être pas en mesure de fournir des mises à jour, des mises à niveau ou des améliorations pour votre Téléviseur, et vous pourriez ne plus être en mesure de continuer à utiliser votre Téléviseur ou votre compte Roku.

Utilisation autorisée et restrictions

Le Téléviseur et le Logiciel sont destinés à un usage personnel et non commercial uniquement. Toute reproduction ou toute redistribution du contenu offert par le Téléviseur est strictement interdite et nous pourrions vous empêcher de copier ou de redistribuer tout élément du Logiciel ou du contenu à l'aide d'un système de gestion des droits numériques ou d'autres technologies. Le Téléviseur et le Logiciel sont uniquement destinés à une utilisation dans les pays dans lesquels le fabricant de votre Téléviseur a autorisé leur vente. Si vous utilisez le Téléviseur et le Logiciel en dehors de ces pays, les droits accordés en vertu du présent CLUF ne s'appliquent pas. Certains des Fournisseurs de contenu utilisent des technologies qui permettent de vérifier votre situation géographique et vous pourriez ne pas être en mesure d'utiliser le Téléviseur ou le Logiciel pour accéder au Contenu en dehors du pays ou de l'emplacement autorisé par Roku ou le Fournisseur de contenu. Sauf dans la mesure expressément indiquée dans le présent CLUF, vous n'acquérez aucune propriété intellectuelle ou aucun autre droit de propriété de quelque nature sur le Téléviseur, le Logiciel ou le Contenu, y compris les droits de brevets, les inventions, les améliorations, les conceptions, les marques, les droits de base de données ou les droits d'auteur, et vous n'acquérez aucun droit sur tout renseignement confidentiel ou secret commercial. Tous les droits qui vous ne sont pas expressément concédés dans le présent CLUF sont réservés par Roku ou ses concédants de licence applicables. Vous ne pouvez pas supprimer, obscurcir, modifier ou dissimuler toute marque, tout logo, tout droit d'auteur ou toute autre mention de droit de propriété dans ou sur n'importe tout Téléviseur, Logiciel ou Contenu.

Le Logiciel est la propriété de Roku ou d'une tierce partie licenciée et peut être utilisé uniquement avec le Téléviseur. Sous réserve du présent CLUF et, le cas échéant, des licences applicables de tiers, vous détenez une licence non exclusive et non transférable d'utilisation du Logiciel et de toute version mise à jour qui vous est fournie par Roku, seulement dans le Téléviseur et sous la forme qu'il incorpore. Ceci constitue une licence et non une vente. Vous ne pouvez pas (a) copier, céder, louer ou vendre le Logiciel ou accorder une sous-licence pour ce dernier; (b) distribuer ou autrement transférer le Logiciel, sauf comme incorporé dans le Téléviseur, pourvu que vous ne conserviez aucune copie du Logiciel et que le destinataire lit et s'engage à respecter cet accord de licence (y compris tous les amendements); (c) modifier, adapter, traduire ou créer des œuvres dérivées du Logiciel (sauf dans la mesure où toute restriction qui précède est interdite par la loi applicable ou jugée

acceptable par les termes de la licence régissant tout code utilisé avec autorisation fourni avec le Logiciel); (d) décompiler, désassembler, désosser ou autrement extraire le code source du Logiciel, sauf dans la mesure où ces gestes ne peuvent être

interdits en vertu de la loi applicable parce qu'ils sont essentiels à l'interopérabilité du Logiciel avec un autre logiciel, et pourvu que les renseignements obtenus par vous au cours de ces activités sont (i) utilisés uniquement pour réaliser cette interopérabilité; (ii) non divulgués sans le consentement écrit de Roku obtenu préalablement; et (iii) ne sont pas utilisés pour créer un logiciel qui est substantiellement similaire au Logiciel; (e) usurper, contourner ou gêner tout mécanisme de sécurité ou toute mesure de contrôle d'accès, ou (f) faire effectuer ce qui précède pour vous par un tiers. Cette licence n'inclut pas le droit de recevoir des mises à jour ou des mises à niveau logicielles. Votre droit d'utiliser le Téléviseur et le Logiciel sera immédiatement annulé sur violation du présent CLUF.

Mises à jour logicielles

À SA SEULE DISCRÉTION, ROKU PEUT FOURNIR DES MISES À JOUR SUR VOTRE TÉLÉVISEUR PAR INTERNET, Y COMPRIS DES CORRECTIFS, DES MISES À JOUR, DES MODIFICATIONS DE L'INTERFACE OU DE LA MANIÈRE D'ACCÉDER AU CONTENU, ET D'AUTRES CHANGEMENTS QUI PEUVENT AJOUTER, ALTÉRER OU SUPPRIMER DES FONCTIONNALITÉS ET DES CARACTÉRISTIQUES. VOUS RECONNAISSEZ QUE CES MISES À JOUR (A) PEUVENT SE PRODUIRE AUTOMATIQUEMENT EN ARRIÈRE-PLAN À TOUT MOMENT (ET QU'ELLES NE PEUVENT PAS ÊTRE DÉSACTIVÉES PAR VOUS); ET (B) NÉCESSITENT UNE CONNEXION INTERNET ET QUE VOUS POURRIEZ DEVOIR PAYER DES FRAIS DE DONNÉES SUPPLÉMENTAIRES À VOTRE FOURNISSEUR DE CONNEXION INTERNET. VOUS COMPRENEZ QUE CES MISES À JOUR SONT NÉCESSAIRES POUR MAINTENIR LA COMPATIBILITÉ AVEC LES AUTRES MISES À JOUR DE PRODUITS OU DE SERVICES DE ROKU ET QU'ELLES PEUVENT ÊTRE NÉCESSAIRES POUR DES RAISONS DE SÉCURITÉ. EN UTILISANT LE TÉLÉVISEUR, VOUS ACCEPTEZ DE RECEVOIR CES MISES À JOUR.

Code sous licence distincte

Certains composants du Logiciel sont fournis sous les termes distincts de licence de tiers (« Code sous licence distincte ») et votre droit d'utiliser ces composants est régi par les modalités de cette licence. Veuillez visiter le https://www.roku.com/separatelylicensedcode pour obtenir de plus amples renseignements.

Recherche vocale

Si vous la téléchargez sur votre téléphone ou appareil mobile, l'application mobile Roku vous permet d'utiliser votre voix et la recherche vocale pour chercher du contenu sur votre Téléviseur. Lorsque vous choisissez d'utiliser la recherche vocale, vous acceptez que Roku et/ou un fournisseur tiers fournisseur engagé par Roku aient votre consentement pour enregistrer, traiter et stocker vos entrées vocales (par exemple, un enregistrement et l'interprétation de ce qui a été dit) et utilisent ces entrées vocales avec d'autres renseignements sur votre Téléviseur (par exemple, identificateur de périphérique) pour fournir des services liés à la recherche vocale pour vous afin d'améliorer la précision et la qualité du service, comme cela est décrit dans la politique de confidentialité de Roku. Pour en savoir plus sur la recherche vocale, visitez les pages de FAQ du site de Roku au www.roku.com/support.

AUCUNE GARANTIE DE LA PART DE ROKU; LIMITATION DE RESPONSABILITÉ

VOTRE GARANTIE RELATIVE AU TÉLÉVISEUR EST FOURNIE PAR LE FABRICANT DU TÉLÉVISEUR ET NON PAS PAR ROKU. ROKU NE VOUS OFFRE AUCUNE GARANTIE EN VERTU DU PRÉSENT CLUF. SANS RESTREINDRE LA PORTÉE GÉNÉRALE DU PRÉSENT AVIS DE NON-RESPONSABILITÉ, DANS LES LIMITES PERMISES PAR LES LOIS APPLICABLES :

(A) LE CODE SOUS LICENCE DISTINCTE ET LE LOGICIEL SONT FOURNIS « TELS QUELS », ERREURS COMPRISES, SANS GARANTIE D'AUCUNE SORTE. ROKU RENONCE À TOUTES LES AUTRES GARANTIES ET CONDITIONS, Y COMPRIS LA GARANTIE IMPLICITE DE QUALITÉ MARCHANDE, DE QUALITÉ SATISFAISANTE, D'ADÉQUATION À UN USAGE PARTICULIER ET D'ABSENCE DE CONTREFAÇON. ROKU NE PEUT GARANTIR, DÉCLARER NI CERTIFIER QUE LE TÉLÉVISEUR, LE CODE SOUS LICENCE DISTINCTE ET LE LOGICIEL SERONT : (I) SÉCURISÉS, SANS VIRUS OU SANS ERREUR, OU (II) DÉNUÉS DE TOUTE ATTAQUE OU INTRUSION DE SÉCURITÉ.

(B) EN AUCUN CAS ROKU, SES ADMINISTRATEURS, SES DIRIGEANTS OU SES EMPLOYÉS NE SERONT RESPONSABLES ENVERS VOUS POUR TOUTE LÉSION CORPORELLE OU TOUT DOMMAGE MATÉRIEL, OU TOUT DOMMAGE PARTICULIER, ACCESSOIRE, EXEMPLAIRE, PUNITIF, INDIRECT OU IMMATÉRIEL DE QUELQUE NATURE DÉCOULANT DE TOUT TÉLÉVISEUR, CODE SOUS LICENCE DISTINCTE, LOGICIEL OU DE VOTRE UTILISATION DE CEUX-CI; ET

(C) VOUS ACCEPTEZ QUE (I) LA RESPONSABILITÉ CUMULATIVE DE ROKU, DE SES ADMINISTRATEURS, SES DIRIGEANTS OU SES EMPLOYÉS, EN VERTU DU PRÉSENT CLUF, NOTAMMENT SA RESPONSABILITÉ CONCERNANT TOUS LES TÉLÉVISEURS ASSOCIÉS À VOTRE COMPTE ROKU, AINSI QUE LE CODE SOUS LICENCE DISTINCTE ET LE LOGICIEL INSTALLÉ SUR DE TELS TÉLÉVISEURS, ET VOTRE UTILISATION DE CEUX-CI, NE DÉPASSERA PAS LE MONTANT SPÉCIFIÉ DANS LES CONDITIONS GÉNÉRALES DU COMPTE ROKU QUE VOUS AVEZ ACCEPTÉES POUR VOTRE COMPTE ROKU, ET QUE (II) ROKU, SES ADMINISTRATEURS, SES DIRIGEANTS ET SES EMPLOYÉS NE SERONT PAS RESPONSABLES ENVERS VOUS, EN VERTU DU PRÉSENT CLUF, POUR LES DOMMAGES DIRECTS DÉCOULANT DU TÉLÉVISEUR OU EN LIEN AVEC CELUI-CI. LES LIMITATIONS CI-DESSUS S'APPLIQUENT MÊME SI LE RECOURS PRÉVU AUX PRÉSENTES ÉCHOUE DANS SON OBJECTIF PRINCIPAL ET MÊME SI ROKU, SES ADMINISTRATEURS, DIRIGEANTS OU SES EMPLOYÉS ONT ÉTÉ AVISÉS DE LA POSSIBILITÉ D'UNE TELLE RESPONSABILITÉ.

CERTAINS TERRITOIRES N'AUTORISENT PAS L'EXCLUSION DE CERTAINES GARANTIES OU LA LIMITATION DE RESPONSABILITÉ POUR CERTAINS TYPES DE DOMMAGES, CERTAINES LIMITATIONS MENTIONNÉES DANS CETTE SECTION PEUVENT NE PAS VOUS CONCERNER. RIEN DANS LES PRÉSENTES CONDITIONS D'UTILISATION NE DOIT AFFECTER TOUT DROIT ACCORDÉ PAR LA LOI QUI S'APPLIQUE À VOUS ET VOUS POURRIEZ AUSSI DISPOSER D'AUTRES DROITS QUI VARIENT D'UN TERRITOIRE À L'AUTRE.

Contrôles à l'exportation

Vous acceptez de ne pas télécharger tout Contenu ou Logiciel, ni autrement exporter ou réexporter tout Téléviseur ou Logiciel dans (ou à un ressortissant ou un résident de) Cuba, Irak, Libye, Corée du Nord, Iran, Syrie ou tout autre pays contre lequel les États-Unis ou votre pays tient un embargo, ou à toute personne figurant sur la List of Specially Designated Nationals du Treasury Department des États-Unis ou du Table of Denial Orders du Commerce Department des États-Unis ou toute autre liste restreinte similaire publiée par votre gouvernement de temps à autre. En utilisant un Téléviseur ou le Logiciel, vous représentez un pays autre que ceux figurant sur une telle liste et vous garantissez que vous n'êtes pas situé dans un tel pays, sous le contrôle d'un tel pays, ou que vous n'êtes pas un ressortissant ou un résident d'un tel pays.

Choix de compétence; règlement des litiges

A. Si vous êtes un consommateur ou un résident d'un pays appartenant au territoire économique européen dans lequel la vente du Téléviseur est expressément autorisée par son fabricant, le présent CLUF ne s'applique pas à votre cas.

B. Dans tous les autres cas, notamment si vous êtes un résident des États-Unis (et de ses possessions et territoires) ou du Canada, vous acceptez que cet accord de licence soit régi par les lois de l'état de la Californie, sans tenir compte de tout conflit de principes de droit qui peut s'appliquer à la loi d'un autre territoire; et :

1. Vous et Roku acceptez d'être liés par les modalités énoncées ci-dessous pour résoudre toute réclamation entre vous et Roku résultant de tout aspect du présent CLUF ou relative à celle-ci, qu'elle se fonde sur un contrat, un délit civil, une loi, une fraude, une fausse déclaration ou toute autre théorie juridique, y compris, mais sans s'y limiter, à des réclamations entre vous et Roku liées au Téléviseur et au Logiciel. Chaque réclamation est dénommée individuellement en tant que « Réclamation » et collectivement en tant que « Réclamations ».

2. VOUS ET ROKU CONSENTEZ À CE QUE TOUTE RÉCLAMATION ENTRE VOUS ET ROKU SOIT TRANCHÉE DE FAÇON DÉFINITIVE PAR ARBITRAGE, À L'EXCEPTION DES RÉCLAMATIONS QUI FIGURENT AU PARAGRAPHE 4 CI-APRÈS DE LA PRÉSENTE SECTION. L'arbitrage doit avoir lieu dans le comté de Santa Clara, en Californie, et doit être administré par l'American Arbitration Association (l'« AAA ») suivant les règles en vigueur de l'AAA, incluant (le cas échéant) les Procédures Additionnelles de l'AAA concernant les différends de consommateurs. Soyez informé qu'il n'y a aucun juge ni jury en arbitrage. Les procédures d'arbitrage sont simplifiées et plus limitées que les règles applicables devant les tribunaux et la révision des décisions de l'arbitre par un tribunal est limitée. VOUS ET ROKU CONSENTEZ EN OUTRE À CE QUE VOUS ET ROKU PUISSIEZ PRÉSENTER UNE RÉCLAMATION À L'ENCONTRE DE L'AUTRE PARTIE UNIQUEMENT SUR UNE BASE INDIVIDUELLE ET NON À TITRE DE REQUÉRANT OU DE MEMBRE D'UN GROUPE DANS TOUTE ACTION OU TOUT RECOURS COLLECTIF. L'ARBITRE NE PEUT CONSOLIDER OU JOINDRE PLUS D'UNE RÉCLAMATION PAR PERSONNE ET NE PEUT PRÉSIDER AUCUN RECOURS CONSOLIDÉ OU COLLECTIF. L'ARBITRE PEUT ACCORDER TOUTE FORME DE RÉPARATION (INCLUANT UNE RÉPARATION MONÉTAIRE, INJONCTION OU MESURE DÉCLARATOIRE) SUR UNE BASE INDIVIDUELLE SEULEMENT ET NE PEUT ACCORDER AUCUNE FORME DE RÉPARATION CONSOLIDÉE OU COLLECTIVE. Nonobstant toute disposition contraire, si la renonciation au recours collectif prévue au présent paragraphe est jugée invalide ou non exécutoire ou si un arbitrage est autorisé à procéder sur une base collective, ni vous ni Roku ne serez dès lors autorisés à soumettre les Réclamations à l'arbitrage. La présente clause d'arbitrage est assujettie au Federal Arbitration Act. La décision de l'arbitre liera vous et Roku et peut être homologuée par tout tribunal compétent.

3. Vous trouverez les renseignements concernant l'AAA et la façon dont l'arbitrage est initié à l'adresse www.adr.org ou en téléphonant au 800-778-7879. Pour toute Réclamation entre Vous et Roku de 75 000 USD et moins, vous serez responsable des frais initiaux de demande d'arbitrage, jusqu'à concurrence du montant des frais initiaux de la demande que vous auriez été appelé à payer pour une poursuite judiciaire initiée pour ces mêmes Réclamations à l'encontre de Roku devant les tribunaux. Si l'arbitre juge les Réclamations non frivoles, Roku paiera la différence entre de tels frais plus les frais de l'arbitrage. Pour toute Réclamation entre vous et Roku qui excède 75 000 USD, si vous êtes en mesure de démontrer que les frais de l'arbitrage sont prohibitifs par rapport aux frais de justice, Roku paiera le montant de vos frais de demande réels et les frais de l'arbitrage, jugés nécessaires par l'arbitre afin d'éviter que les frais d'arbitrage ne deviennent prohibitifs par rapport aux frais de justice.

4. Cette convention d'arbitrage ne concerne pas toute revendication (a) dans laquelle une partie tente de protéger ses droits de propriété intellectuelle (tels que son brevet, copyright, marque déposée, secret commercial, ou des droits moraux, mais ne comprenant pas sa vie privée ou les droits de publicité), ou (b) qui peut être intentée devant le tribunal des petites créances.

5. Si cette entente d'arbitrage est jugée invalide, non exécutoire ou inapplicable pour une Réclamation donnée entre Vous et Roku, toute procédure visant à résoudre telle Réclamation devra dès lors être présentée exclusivement devant un tribunal fédéral ayant juridiction dans le District Nord de Californie ou un tribunal d'État du comté de Santa Clara en Californie. Vous consentez irrévocablement à la juridiction exclusive de ces tribunaux.

6. Droit de retrait de 30 jours : vous avez le droit de vous retirer de cette entente d'arbitrage en envoyant un avis écrit de votre décision de vous retirer à l'adresse suivante : Legal Department, Roku, Inc., 150 Winchester Circle, Los Gatos, CA 95032, États-Unis; à condition que le cachet d'un tel avis soit daté du 30e jour, ou moins, suivant le premier événement se produisant parmi les choix ci-après, si vous ne possédez pas encore de Compte Roku Account : (a) la date d'achat de Votre Téléviseur ou (b) la date de création de votre Compte Roku. Si vous possédez un compte Roku, tous les appareils que vous choisissez de lier à votre compte Roku et tous les services fournis par Roku qui sont accessibles à l'aide de ces appareils seront soumis à cette convention d'arbitrage. Votre avis doit indiquer votre prénom et nom complets, votre adresse postale, votre numéro de téléphone et votre adresse courriel actuels, le nom du produit et le numéro de série afférent à votre Téléviseur, ainsi qu'une copie de la preuve originale de l'achat de votre Téléviseur. Si vous envoyez en temps opportun un avis en conformité avec le présent paragraphe 6, la convention d'arbitrage ne pourra pas s'appliquer à vous-même ou à Roku. Si vous ne transmettez pas cet avis dans les délais impartis, alors vous consentez à être lié par cette entente d'arbitrage.

7. Nonobstant toute disposition contraire de cette Entente, vous reconnaissez que si Roku veut supprimer ou modifier substantiellement l'entente d'arbitrage ci-devant, ladite suppression ou modification ne s'appliquera pas à une Réclamation individuelle pour laquelle vous avez avisé Roku préalablement à ladite suppression ou modification.

Divers

En vertu de ce CLUF, Roku peut transférer ses droits et ses obligations à une autre organisation. Vous pouvez uniquement transférer vos droits ou vos obligations en vertu de ce CLUF à une autre personne si Roku y consent par écrit. Ce CLUF est entre vous et Roku. Aucune autre personne n'aura le droit de faire respecter ces conditions. Chacun des paragraphes du présent CLUF a effet séparément. Si un tribunal ou une autre autorité compétente décide que l'un d'entre eux est illicite, les paragraphes restants resteront en vigueur. Si Roku ne parvient pas à s'assurer que vous respectez vos obligations aux termes du présent CLUF ou si Roku n'applique pas ses droits contre vous, ou si Roku tarde à le faire, cela ne signifiera pas que Roku a renoncé à ses droits contre vous, ou que vous n'avez pas à vous conformer à ces obligations. Si Roku renonce à intenter un recours en cas de manquement de votre part, Roku ne le fera que par écrit, mais cela ne signifiera pas que Roku renoncera automatiquement à tout manquement ultérieur de vous.

Coordonnées

Si vous désirez communiquer avec Roku, veuillez nous envoyer votre courrier à l'adresse suivante Roku, Inc., 150 Winchester Circle, Los Gatos, CA 95032, États-Unis ou par courriel à l'adresse customerservice@roku.com.

Dernière mise à jour : 21 avril 2016

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Exhibit H

Roku SDK Documentation / Roku SDK Documentation

Roku Advertising Framework

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Overview

The Roku Advertising Framework (RAF) is a universal video ad solution integrated directly into the core Roku SDK as a common library. RAF is required for channels that include ads, see Certification.

RAF natively integrates baseline and advanced advertising capabilities, including:

- IAB[1] VAST[2] 2.0/3.0 processing
- IAB VMAP[3] playlist management
- Interactive ad units
- Roku's new privacy-friendly device ID ("RIDA")[4]
- Nielsen DAR Support - a comprehensive, next-day view of your ad's online and mobile audience in a way comparable to the Nielsen TV ratings
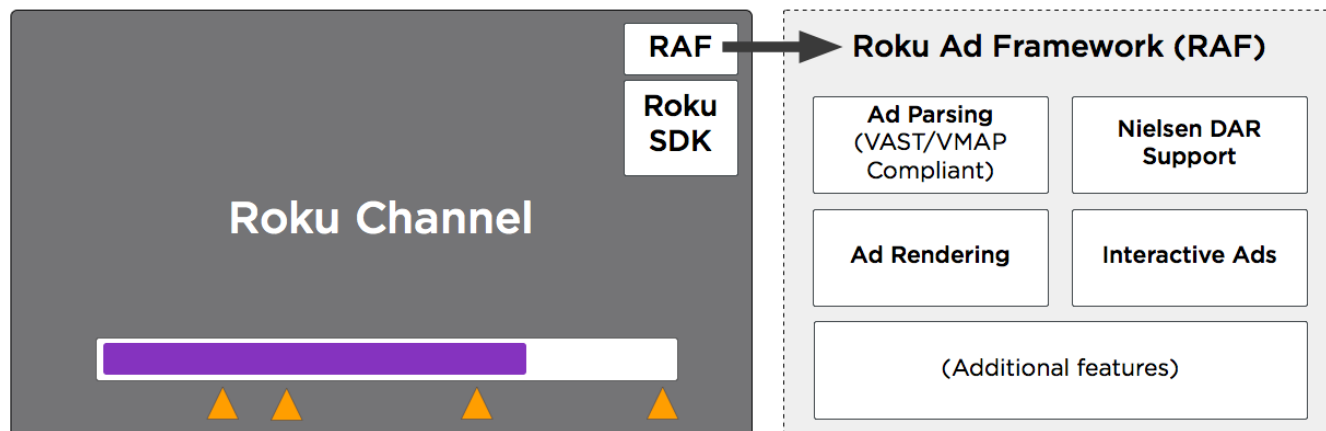
Other benefits of the framework include:

- Allows developers to continue using their preferred ad server (e.g. Freewheel, DFP)
- Automatically updates without rebuilding/resubmitting your app
- Standardizes client-side ad insertion across all apps

The Roku Advertising Framework is intended to provide advanced advertising fulfillment and rendering capabilities to applications. The library supports a variety of ad services, and rendering of both video ads and interactive ads. By deploying as a common library, we reduce the overhead of implementation and maintenance for individual channel application developers, and provide a consistent user experience for all applications. The library is designed to support multiple use cases, providing applications with flexibility to control as little or as much of the ad rendering process as desired.

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[1]The International Advertising Bureau is an organization comprised of 650+ media and technology companies. The IAB evaluates and recommends standards and practices and conducts research on interactive advertising.

[2]Video Ad Serving Template is an IAB specification for a universal XML schema for serving ads to digital video players.

[3]Video Multiple Ad Playlist is an IAB specification for an XML template that video content owners can use to describe the structure for ad inventory insertion. It is commonly used in conjunction with VAST to structure ads into ad pods.

[4][RIDA] The Roku ID for Advertising is a device identifier to track activity for development and marketing purposes. It is designed to generally follow the guidelines established for the IDFA (Identifier for Advertising) used by other platforms. The RIDA limits disclosure of users' identifying information and allows the ability to opt-out of remarketing or reset the ID at any time. The RIDA ID must only be passed if "limit ad tracking" is not set in the Roku Settings UI. See GetAdvertisingId(), IsAdIdTrackingDisabled(), and GetPublisherId() for details.

Advantages

The Roku Advertising Framework (RAF) positions the publisher for the future of video advertising on the Roku platform. RAF exists as a universal ad structure across all channels and Roku devices. All channels that have integrated RAF will benefit from Roku's development of new ad features.

- RAF eases the inherit complexities of enabling a Roku channel for video advertising, while providing a robust and powerful feature set. From the ground up, RAF is designed for simple integration.
- Implementation of the framework is mutually beneficial to all involved parties, so will grow the AVOD ecosystem of consumers, advertisers, and channels:
    - Consumers – Better ad experience (e.g., interactivity, frequency capping) means significantly increased consumption of free content on AVOD channels.
    - Advertisers – RAF addresses long-standing obstacles for advertisers who want to buy media on the Roku platform.
    - Channels – Superior tools for additional possibilities to monetize publisher inventory.
- New features added to RAF will not require further integration work, as the functionality resides within the Roku OS.
- RAF and all further RAF releases are certified to function on the Roku platform, and will receive full support from Roku.
- RAF is fully compatible with any VAST 2.0 ad server, and replaces the existing VAST library code.

Features

- Automatic appending of key targeting parameters in the ad request (Roku ID for Advertising, content genre, display dimensions, etc.)
- IAB VAST 2.0/3.0 parsing
- IAB VMAP parsing
- FreeWheel SmartXML[5] parsing
- Interactive ad rendering
- Audience measurement

VAST 2.0 Feature	Supported	VAST 3.0 Feature	Supported	VMAP Feature	Supported
Wrapper and Inline Ads	Y	Ad pods[6] via sequence attribute	Y	Ad pods playlists	Y
Tracking Events	Y	Extended error tracking	Y	Tracking events	Y
Linear Ads	Y	VAST tracking macros	Y	'repeatAfter' AdBreak attribute	N

VAST 2.0 Feature	Supported		VAST 3.0 Feature	Supported	VMAP Feature	Supported
ClickThrough (interactive ads)	Y		Ad "buffet" selection	Y	Extension elements	N
Companion Ads	"image/jpeg", "image/png" (parsing only, not rendered)		Skippable linear ads	N		
MediaFile	"video/mp4", "video/x-mp4", "application/x-mpegurl", "application/json"		OBA[7] industry icon	N		
Non-Linear Ads	N					
Extension elements	N					

[5]FreeWheel's proprietary standard combines ad payload and ad scheduling in a single XML file.

[6]In the context of ad delivery, a pod is a sequence of ads that is rendered consecutively during a single ad break. An ad pod may also consist of a single ad.

[7]Online Behavioral Advertising refers to the practice of collecting information about online activity to target ads based on relevance.

Nielsen DAR Agreement

Roku Ads are integrated with Nielsen audience measurement and is required for all Ad-supported channels. When integrating the Roku Ad Framework, you acknowledge and agree to the following:

(i) that turning on these features will cause device and content viewing information provided by your Roku Channel to the Roku SDK to be automatically appended to Nielsen digital ad ratings ("DAR") beacons received in VAST responses and sent to Nielsen;

(ii) Nielsen may have personally identifiable information ("PII") on certain end users of the Roku platform;

(iii) these features will enable third party advertisers, agencies and media resellers (including Roku's ad sales team if Roku is a reseller of your ad inventory) to serve VAST responses with Nielsen DAR campaign beacons into your channel, and receive reports on the performance of those DAR campaigns; and

(iv) if you are not a Nielsen DAR customer, you may not receive reports on DAR campaigns. If you choose to turn on the Nielsen audience measurement features, you hereby represent and warrant:

(i) that you will notify your users of the occurrence of audience measurement;

(ii) you have and will maintain a legally adequate privacy policy;

(iii) you have and will maintain all necessary rights from Nielsen and consents from users to use the Nielsen audience measurement features; and

(iv) your use of the Nielsen audience measurement features will comply with all applicable laws, rules and regulations.

In the event that Roku runs an ad campaign on your channel, Roku may, in its sole discretion, provide to you or your ad agency, as applicable, excerpts of the Nielsen DAR that relate to the delivery and performance of advertisements on your ad inventory. You hereby agree to

(i) maintain the confidentiality of any Nielsen DAR reports provided to you by Roku; and

(ii) maintain in the Nielsen DAR reports any sourcing and copyright information provided by Nielsen.

YOU AGREE YOU WILL NOT USE THE NIELSEN AUDIENCE MEASUREMENT SOFTWARE AND FEATURES IN CONNECTION WITH CONTENT OR CHANNELS DIRECTED TOWARD CHILDREN OR IN CONNECTION WITH USERS KNOWN TO BE CHILDREN. If Roku discovers or determines in its sole discretion that you are using the Nielsen audience measurement software and features in connection with content or channels directed toward children or with users known to be children, Roku reserves the right to disable or otherwise limit functionality.

YOU MAY NOT ENABLE THE NIELSEN AUDIENCE MEASUREMENT FEATURES IF YOU DO NOT AGREE TO ABOVE. PLEASE CONTACT ROKU OR NIELSEN FOR FURTHER INFORMATION.

Revenue Share

A channel publisher can have the Roku Ad sales team sell ads on the channel on their behalf. In such cases, Roku and the channel publisher can agree to share the advertising revenue in one of two ways:

- inventory split, where the total amount of ad inventory for the channel is split by an agreed-upon percentage, with Roku and the channel publisher each selling their respective percentage of the inventory
- revenue split, where all of the ad inventory for the channel is sold by Roku, with an agreed-upon percentage of the revenue returned to the channel publisher by Roku

When implementing RAF for your channel, it is important to set the URL to the correct ad server according to the revenue share agreement between Roku and your channel publisher, if it exists. The ad server URL is set as the argument to `setAdUrl()`.

Inventory Split

For an inventory split agreement, set the URL in `setAdUrl()` to the ad server used by your channel for those ads sold by your channel publisher. For the percentage of inventory served by Roku, please contact advertising@roku.com to request a VAST tag.

Revenue Split

Since by default, any ads served without an ad server URL will be served by a Roku ad server, you can omit the URL argument, or the `setAdUrl()` call entirely, for revenue split agreements.

Integrating RAF In Your Channel

For steps to getting started, use cases, and the full API reference, see Integrating the Roku Advertising Framework.

Sample Channels

The table below provides a number of samples channels to help you get started with your own RAF implementations:

Download File	SDK Version	Description
RAF Video Node Sample	SceneGraph	This sample demonstrates the use of RAF in a Video node with support for pre, mid, and post roll ads.
FullRAFSceneGraphSample.zip	SceneGraph	This sample shows how to add RAF to a channel, configure Nielsen, obtain ads and play them as pre-, mid- and post-rolls. It also shows how to import Ads from non-standard feed (neither VMAP, VAST or SMartXML.)
CustomBufferScreenSceneGraphSample.zip	SceneGraph	This sample shows how to change default ad buffering screen background, title and description. It also shows how to create a completely custom buffering screen.
FullRAFSDK1Sample.zip	Legacy SDK	This sample shows how to add RAF to a channel, configure Nielsen, obtain ads and play them as pre-, mid- and post-rolls. It also shows how to import Ads from non-standard feed (neither VMAP, VAST or SMartXML.) This sample also contains examples of custom buffering screens and stitched ads.
CustomBufferingScreenSDK1Sample.zip	Legacy SDK	This sample shows how to change default ad buffering screen background, title and description. It also shows how to create a completely custom buffering screen.
ServerStitchedAdSDK1Sample.zip	Legacy SDK	This sample demonstrates the interactive stitched ads feature. It shows how to configure RAF with interactive ads and process interactive ad events.

For the full RAF integration cases, the samples:

1. Initializes RAF
2. Turns on Nielsen tracking, and configures it with genre, program ID, and content parameters

3. Configures the ad URL using URL macros (See URL Parameter Macros in Integrating the Roku Advertising Framework) and the `setAdUrl()` method
4. Gets the ads using getAds() (VAST feed), and renders them using showAds()

For non-standard ad responses, ads are imported from a non-standard feed, neither VMAP, VAST or SmartXML. RAF is configured as if for a standard feed, with backfill ads disabled and extra debug output enabled. Ads are parsed from local JSON file, then formatted as an ad pods array, and imported into RAF using the `importAds()` method. After that, the sample checks for particular ads to play by passing video playback events to the RAF `getAds()` method inside event loop. If any ads were returned from `getAds()`, they are rendered using the RAF `showAds()` method. For the Scene Graph example, after `importAds()`, the sample checks for particular ads to play by passing fake video events created with `createPlayPosMsg()` to the RAF `getAds()` method before event-loop (preroll ads) and inside it (midroll/postroll ads). If any ads were returned from `getAds()`, they are rendered using the RAF `showAds ()` method.

Release Notes

Version 2.5 – 05/2018

- Major rework of RAF's diagnostic output to BrightScript console
  - Warning messages (prefixed with "[RAF.err]") are always printed for known potential problems. Note that these are just additional diagnostics - they do not change the library's behavior, as compared to previous versions.
  - Substantially more information is printed when in *setDebugOutput(true)* mode: method call arguments and return values, URL macros expansion, ad XML/parsed, etc.
- New interactive templates by BrightLine/Innovid
- Bug fixes
- RAF 2.5 is deployed to devices with Roku OS 8.0 and above

Version 2.4 – 03/2018

- New feature: JIT ("Just In Time") ad resolution for VMAP, SmartXML to reduce overhead incurred by prefetching all ad pods before content playback starts
- New feature: RIA ("Roku Interactive Ads") to allow rendering of Roku interactive ad overlays for OTT content (previously only available for ACR on linear content)
- BrightLine bug fixes and performance improvements
- Innovid bug fixes and new templates ("User Satisfaction Survey" and "Skippable" interactive ads)

Version 2.3 – 10/2017

- Add support for BrightLine interactive ads in SSAI+RSG use case
- New interactive ad templates (Innovid)
- Implement ad buffering limit
- Add support for tracking beacons with HTTP → HTTPS redirects
- General performance improvements and bug fixes
- RAF 2.3 available in Roku OS 7.7 and above

Version 2.2 – 07/2017

Features:

- Added a native RSG renderer for Brightline interactive ads
- Enabled the firing of tracking events on empty ad breaks (SmartXML and VMAP; relevant to FreeWheel forecasting)

Bug Fixes:

- Fixed the autoscaling of interactive ads for FHD-only RSG apps on a HD UI device
- Fixed an error when the ad response is invalid XML
- Improved the RIDA hashing when "limit ad tracking" is set
- Improved the draining of pending beacons cache, to benefit low memory devices
- Enhanced the handling of non-standard view sizes (RSG)
- Fixed various minor issues

Version 2.1 – 05/2017

Features:

- Added support for comScore vCE campaign measurement service
- Introducing a generalized audience measurement API (see enableAdMeasurements() for details)
- Support for a new TrueX SAB interactive ad template

Bug Fixes:

- Fix for a display resolution issue when a FHD-only RSG app was playing ad video on a HD UI device
- Miscellaneous other fixes

Version 2.0 – 03/2017

Features:

- Support for RSG apps to use RAF from Task node
- SceneGraph ad rendering support (video ads and Innovid interactive ads)
  - New `view` parameter for showAds() - this is required for all SceneGraph applications
- VAST 3.0 "ad buffet" support
- Extended companion ad tag parsing from VAST to allow multiple ad renderers for different companion creatives
- New interactive ad template support
- New `adCompleted` return value for `stitchedAdHandledEvent()`
- New `provider` member for `companionAds` metadata in Ad Structure

Bug Fixes:

- Fix in VAST parser to address problem with DFP waterfall containing invalid ads
- Multiple bug fixes to address ad rendering in both SDK1 and RSG apps built with different combinations of supported `ui_resolutions`

Version 1.9 – 11/2016

Features:

- Freewheel SmartXML adReplica changes
  - Improve forecasting by only resolving ad requests for wrapped creative renditions that are placed into ad slots
  - Respect replicaId if specified in the adReference tag and a matching replica exists in the creativeRenditions, otherwise treat unwrapped renditions as alternate streams
- When Limit Ad Tracking is set by the user, use a new time-scoped ID that is cycled every 30 days to provide the benefits of frequency capping while still respecting the user's desire to avoid ad tracking
- Added an optional new parameter to the setContentGenre() API to indicate whether content is targeted for kids
- Added a new content macro, ROKU_ADS_KIDS_CONTENT, and modified default/backfill URLs to use this new macro
- Added a new API, getNielsenContentData(), that will return an encrypted N-RIDA parameter string for apps wishing to use Nielsen SDK for DCR measurements
- New BrightLine template

Bug Fixes:

- Eclipse plugin compatibility fixes
- Exit key handling fixes
- TrueX and BrightLine bug fixes and enhancements
- Added a fix for BrightLine ads to use cached ad position
- Fixed 3rd-party tags that used improperly-encoded URL fragments by URL-encoding fragment contents
- Modified garbage collection after interactive ad rendering to fix display issue with BrightLine ads

Version 1.8 – 10/2016

Features:

- Add missing tracking events for plain video ads in server-stitched streams: Impression, Pause, Resume
- Add contextual info for Complete tracking event
- Add companion tracking metadata to Innovid ads, which do not explicitly have a CompanionAd tag to distinguish video ad tracking from microsite tracking
- Add 303 error tracking when wrapped VAST returns no ads
- New BrightLine templates
- Merged Innovid renderer changes, including modifications to tracking pixel logic
- New creativeAdId metadata field for ads

Bug Fixes:

- Fix crash when replacing RAF macros in URL containing query parameter values without a name
- Correct pod-specific tracking for ad pods in server-stitched streams: PodComplete, PodStart
- Disallow re-rendering of ad pod when pod cache has been updated while rendering the pod (e.g., for TrueX ads)
- Re-purpose "Expand" and "Collapse" ad tracking to refer to microsite interactions for Innovid ads, which do not generally have a separate CompanionAd tag in the VAST representation for these additional tracking events
- Ignore replicaId values when specified in SmartXML ad slots, since these always refer to the first replica
- Treat multiple renditions of wrapped ads in SmartXML as replicas
- Override any creative ID set from a wrapped ad with the creativeId attribute in SmartXML, since this is likely more meaningful to the app than the wrapped ID
- Numerous TrueX/BrightLine bug fixes and feature changes
- Track ad render position values to prevent spurious Complete/PodComplete events when exiting microsites (playback of stitched video can resume across ad boundary, resulting in extra tracking pixels being fired)

Version 1.7 – 06/2016

Features:

- New API: setContentMetaData(metaData): allows app to set information about the current content
- Added new HLS MIME type: "application/vnd.apple.mpegurl"
- Added "ai=ROKU_ADS_APP_ID" to default and backfill ad URLs' cust_params
- Changed macro value of ROKU_ADS_LIMIT_TRACKING to "1" or "0" instead of "true" or "false," to accommodate DFP's special LAT values
- Changed handling of invalid messages passed to the event handler for stitched ads to return either the cached ad data if an ad is currently being rendered, or Invalid if no ad is being rendered to accommodate apps that erroneously pass Invalid messages to the handler
- Prioritize MP4 over HLS ad creatives as HLS can take longer than the length of an ad to settle on an acceptable playback bitrate
- Add support for TrueX ad experience and parse new TrueX VAST extensions
- Invalidate rendering of current ad pod if pod cache has been updated
- Parse "special" wrapped URLs inside <asset> tag in SmartXML
- Numerous BrightLine changes to support rendering of choice cards, skip cards, managing ad pod cache when pods are skipped
- Modified backfill URL's slotname parameter to use ROKU_ADS_APP_ID as it was in v1.6
- Merged Innovid's latest code containing important tracking fixes

Bug Fixes:

- Fix to the BrightLine code to address crashes on some devices still running 7.0 FW
- Fix bug that caused lower ad fill rates for SmartXML responses that included erroneous or empty ad tags in a given ad pod
- Fix construction of generic tracking events for SmartXML when quartile events are not specified

Version 1.6 – 03/2016

Features:

- Interactive ads on Server Stitched Ads
- Support for DFP Waterfall
- Customize Buffer Screens - static image only
- Update LR tags to DFP tags
- Innovid- Extender
- New URL parameter macros: ROKU_ADS_LIMIT_TRACKING, ROKU_ADS_APP_VERSION, ROKU_ADS_LIB_VERSION, ROKU_ADS_DEVICE_MODEL

Bug Fixes:

- Loading message was not updating correctly for preroll/midroll/postroll ads
- Pass the raw unchanged value in the ROKU_ADS_TRACKING_ID macro
- Macros were not expanded when held in the URL encoded section of the key/values
- Pre-roll ad in 1080p HD TV didn't display full screen
- BrightScript log is displaying "ERROR: Runtime: FOR EACH value is Invalid" when ad is playing fine

Version 1.5 – 12/2015

Features:

- Max URL transfer count bumped up from 40 to 300
- If Nielsen impressions contained prior values for parameters that should not be substituted due to whitelisting or ad server blacklisting, remove those values from the URL

- set maximum decode resolution on all rendered video ads to avoid memory issue due to buffering algorithm on lower end devices
- Ensure that a properly-handled exit key exits the main video render loop
- Add support for Freewheel "eventCallback"-style impression tracking

Bug Fixes:

- Issue with pressing "back" remote button on image canvas screen
- Fixed VMAP Bug where ad breaks with the same offset were ignored
- Ad Framework unable to parse response - Freewheel Promos
- Fix edge case bug in URL regularization with path parameters
- Fix "PodComplete" tracking sent when interactive ads are exited

Version 1.4 – 10/2015

Features:

- Ability for cross-promotion of channels/content
- Ability to install a channel from a video ad
- Ability to follow content on a channel from a video ad
- Integration of BrightLine Interactive Ads
- Integrate BrightLine Interactive ads to RAF
- Updates to Innovid library (Use "Up" key instead of "*" everywhere)
- SmartXML Parser Changes
- Support "slotImpression" beacon types
- Enhanced Support for quartile tracking events in all scenarios
- Additional attributes such as ad.Title, ad.CreativeId, ad.advertiser for VAST and FreeWheel ads
- String Localization for core UI strings

Bug Fixes:

- SetContentLength API for Nielsen beacons
- Midroll/postroll video playback issues on Roku TVs

Exhibit I

Roku (https://www.roku.com) Developers (https://developer.roku.com/ove

News (/developer/category/news)

Roku OS 7.1: developer highlights

ctraganos - Apr 8th, 2016

The Roku OS 7.1 release is focused on BrightScript improvements, SceneGraph reliability, additional playback features, and extending the RokuTV experience for Digital Television.

Here are a few features from our latest operating system release that you can start building with today:

Roku SceneGraph XML
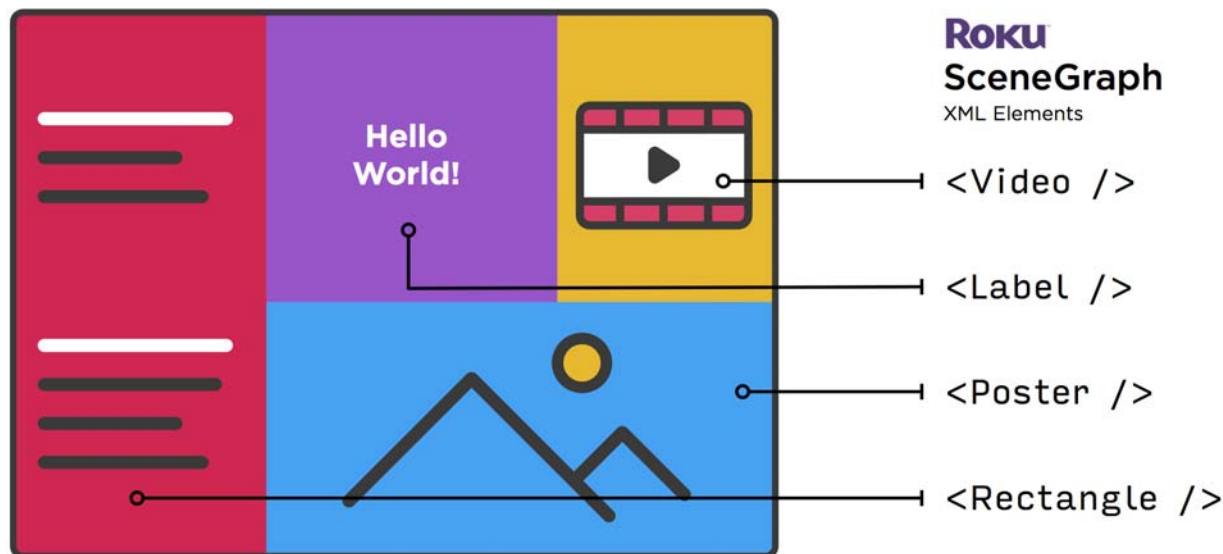
- L10N support
  (https://sdkdocs.roku.com/display/sdkdoc/Scene+Graph+Localization) –
  Localization of URLs, package locale detection, dynamic localized image
  swaps, and translation file support
- Global channel data (m.global node)
  (https://sdkdocs.roku.com/display/sdkdoc/Scene+Graph+Data+Scoping)
  – A new mechanism for easily sharing data between components in a
  channel application including the main thread
- New <Audio> SceneGraph node
  (https://sdkdocs.roku.com/display/sdkdoc/Audio) – Build custom players
  for specific use cases such as podcasts, music collections, and audio
  channels. Supports all major streaming and music formats.
- Improved 'BIF' generator – Great for creating preview thumbnails used
  during FF/Rewind.
- Extendable custom components
  (https://sdkdocs.roku.com/display/sdkdoc/Creating+Custom+Components
  – Ability to extend your own markup and custom elements for re-use across
  projects such as video players, loading indicators, custom grids, and more
- Downloadable Components
  (https://sdkdocs.roku.com/display/sdkdoc/Loading+Component+Libraries)
  – Ability to host your own libraries of reusable code that can be included at
  runtime for SceneGraph channel applications
- Read the full Roku SceneGraph docs here
  (https://sdkdocs.roku.com/display/sdkdoc/Scene+Graph+XML+Guide)

BrightScript
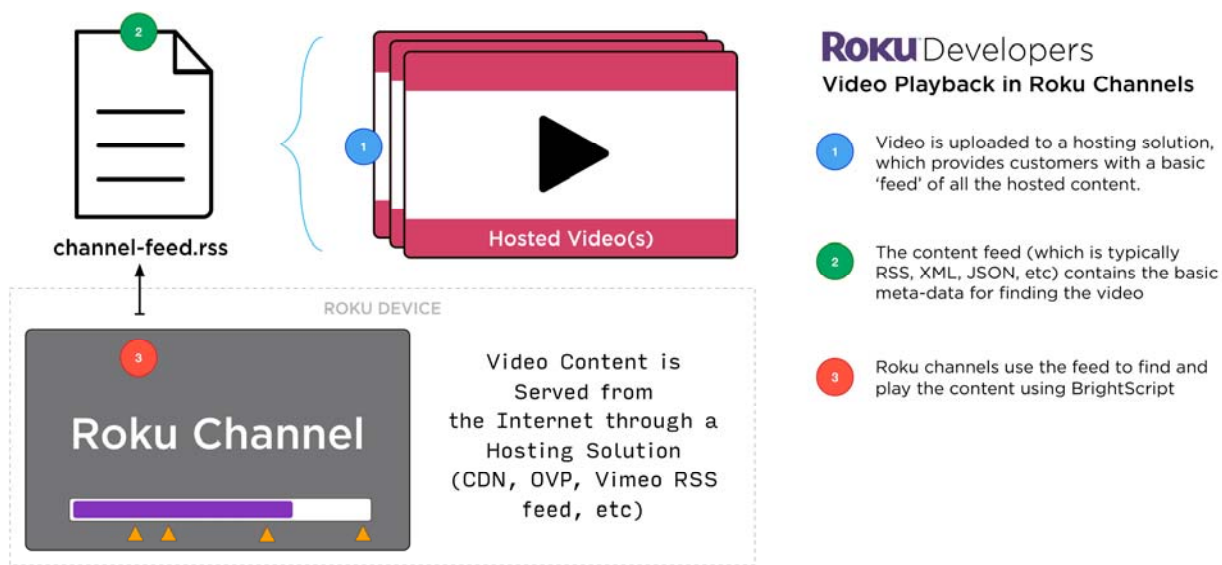
- Array sorting (https://sdkdocs.roku.com/display/sdkdoc/roArray) using Sort(), SortBy(), and Reverse()
- String Split() (https://sdkdocs.roku.com/display/sdkdoc/roString) for efficient splitting using a delimiter
- Improved print functionality (https://sdkdocs.roku.com/display/sdkdoc/Program+Statements#Program PRINTitemlist) – explicitly prints component type for enumerable objects
- XML Parsing gains (https://sdkdocs.roku.com/pages/viewpage.action? pageId=1608549)– Improved XML parsing speed for large elements
- Added Assignment operators (https://sdkdocs.roku.com/display/sdkdoc/Expressions%2C+Variables% 2C+and+Types) (+=, -=, *=, /=, \=, <<=, and >>=)
- Numeric operators – added standard increment/decrement syntax (a++, a –)
- UTF-16 support (https://sdkdocs.roku.com/display/sdkdoc/Global+Utility+Functions) added for roURLTransfer(), GetToString(), AsyncGetToString(), and ReadAsciiFile ()
- Review the full BrightScript language reference here (https://sdkdocs.roku.com/display/sdkdoc/BrightScript+Language+Reference

Roku Ads

(https://blog.roku.com/developer/2016/02/10/roku-ad-framework/)
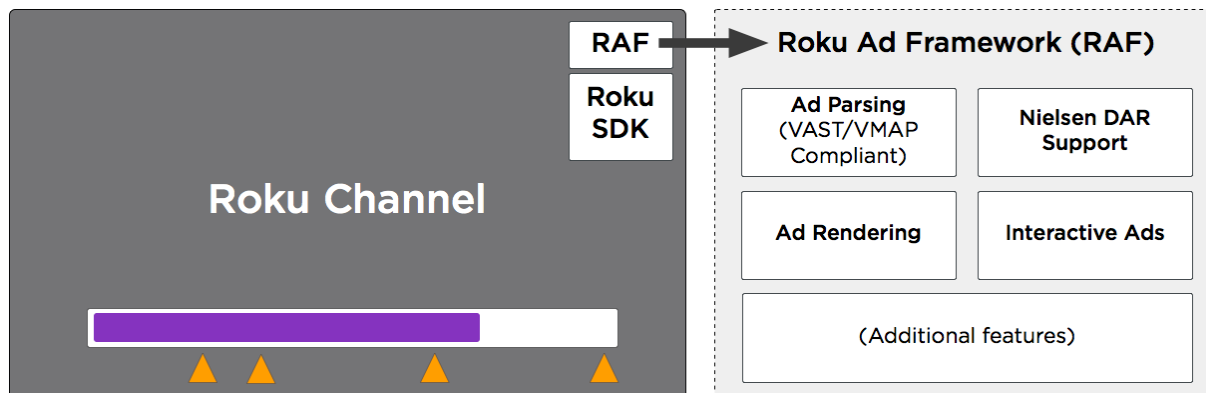
- **HLS Manifest tagging support** – used in dynamic ad insertion for Live & OnDemand streams through inserted tags that mark start/end of Ad breaks and placement. Enables additional metadata passed from ad server to channels for tracking ad events and impressions.
- Read more about the Roku Ad Framework here (https://blog.roku.com/developer/2016/02/10/roku-ad-framework/)

Roku OS
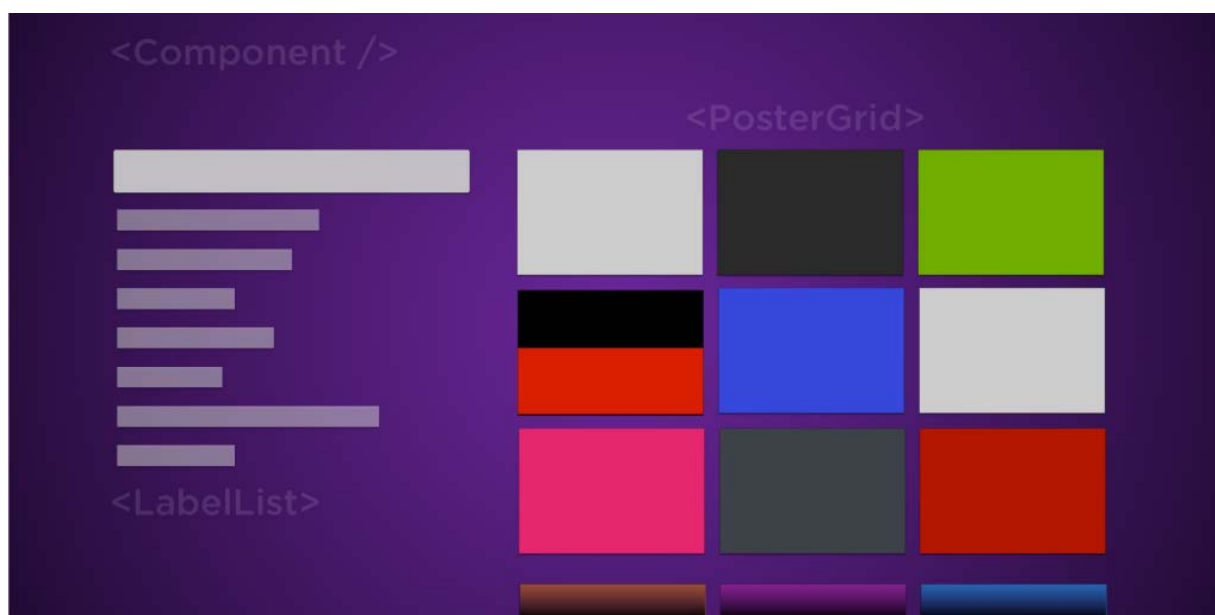
- **Tuner API (https://sdkdocs.roku.com/display/sdkdoc/roTuner)** – For RokuTVs with built-in digital channel tuners, channels can display Digital Television via antenna. This opens up interesting hybrid use cases for an enhanced Digital TV viewing experience.

- **Channel pricing transparency –** Channel store listing pages will indicate when a channel requires cable or satellite subscription. Goal is improving user experience when installing channels and reducing previous confusion of "May require additional fees" vs "free".
- **Sun-setting Channel SD graphics requirements –** Removed the SD assets requirement unless specified in manifest and code. The Roku UI, HD content and channels will render 16:9 and then downsize to SD/4:3 output (no letterboxing) if the Roku Device player is set in "SD mode".
- **Private listening on Roku's mobile app** *(note: this feature is available exclusively for the new Roku Streaming Stick (https://blog.roku.com/blog/2016/04/05/new-roku-streaming-stick/))* – The Roku mobile application on both iOS and Android enables listening of content through both bluetooth and direct audio speakers. Play content on your Roku device while keeping things quiet for everyone around you.

Next steps: Build channels on the Roku platform

(https://blog.roku.com/developer/2016/02/04/hello-world/)

(https://blog.roku.com/developer/2016/03/03/scenegraph-tutorial/)

(https://blog.roku.com/developer/2016/03/03/scenegraph-tutorial/)
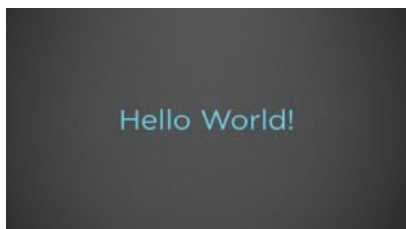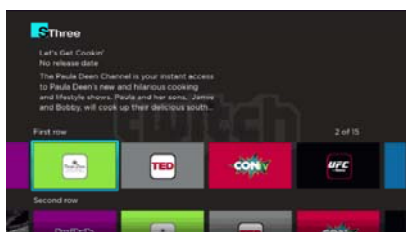
Roku pioneered streaming for the TV, and we aspire to power every TV in the world. As an open streaming platform, we welcome developers from around the world to grow their audience with Roku.

For the full details, please review on sdk docs site: Roku OS 7.1 release notes (https://sdkdocs.roku.com/display/sdkdoc/Release+Notes#ReleaseNotes-SDKUpdateReleaseNotes:version7.14/05/2016)

The following guides will show how to get up and running quickly:

1. The **Developer Setup Guide** (https://blog.roku.com/developer/2016/02/04/developer-setup-guide/) covers the required steps in activating developer features of a Roku device in addition to enrolling your account in the Roku developer program.
2. Our introductory '**Hello World**' **Guide** (https://blog.roku.com/developer/2016/02/04/hello-world/) offers a downloadable sample application for developing on the Roku Platform
3. Our latest **Sample Roku channel and SceneGraph tutorials** (https://blog.roku.com/developer/2016/03/03/scenegraph-tutorial/) will show how a working Roku channel processes media on our devices.

Tags: 7.1 (/tag/7-1)

Links

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Exhibit J

Roku (https://www.roku.com) Developers (https://developer.roku.com/ove

Tips (/developer/category/tips)

Direct Publisher monetization guide

tcharles - Jun 14th, 2018

(https://blog.roku.com/developer/files/2017/05/ad-loading.png)
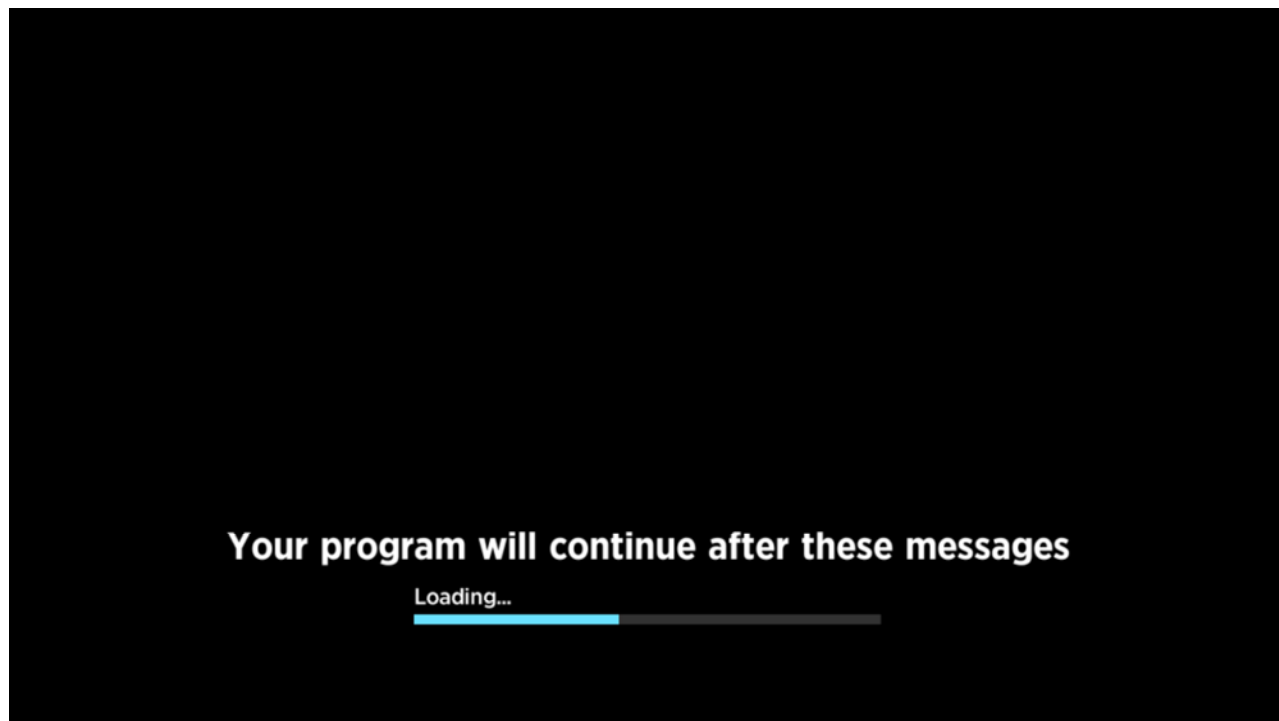
Overview

Hundreds of Roku channels have launched using our Direct Publisher tool (https://developer.roku.com/publish).

In this tutorial, we explain the monetization options for Direct Publisher channels, and how to optimize your channel for greater revenue.

Sections:

- Monetization options

- ◦ Roku Audience Network
- ◦ Custom server
- ◦ How to make an ad selection
- How to insert mid-roll ads
- Ad logic
- Reporting

Monetization options

Currently, Direct Publisher only supports ad monetization. There are two ad options for a channel:

1. Participation in the Roku Audience Network (Revenue share)
2. Using a custom ad server (Ad inventory split)

Roku Audience Network

Publishers looking to monetize their Roku channels can opt to join the Roku Audience Network. This this is an out-of-the-box solution eliminating the need to configure a custom back-end ad server and source ads. Rather, the publisher taps into the robust network of advertisers that Roku's own sales team has already brought onto the platform.

Channels that participate in the Roku Audience Network agree to enter a revenue share with Roku, in which the publisher receives 60% of net revenue earned on advertisements served in their channel.

Publishers can cut their operational costs by leveraging Roku's existing ads team, dedicated to filling your inventory with quality ads. We are sensitive to a channel's audience and we can tailor the ads we serve to your channel. Direct Publisher channels support Nielsen DAR, meaning targeted video ads will be delivered on your content. Our aim is to completely fill a channel's inventory while avoiding back-to-back ads from the same advertiser and low-quality ads.

Your channel will be reviewed shortly after submitting for publication. If the content is deemed appropriate for our ad vendors, your channel will be added to the Network.

Note that participation in the Roku Audience Network is currently only available to channels in the US Channel Store. For ad-monetized channels that you would like to distribute outside of the US, a separate channel will need to be created using your own ad server. In this scenario, you would:

- create a US-only channel and select "I want to use the Roku Audience Network" on the Monetization page.
- create a separate channel and select the additional non-US Channel Store regions in which you want to distribute and monetize your content. On the Monetization page, select "I want to sell my own ads and will configure my own ad server URL."

Channel names in the Roku Channel Store must be unique, so you'll need to give the two channels separate names. This could be as simple as appending "International" to the end of your channel name, or you could use a name that's more unique to your channel's brand.

Custom ad server

Publishers also have the option of using their own ad servers to monetize their Direct Publisher channels. The publisher is responsible for sourcing their own ads and configuring the server.

Channels that monetize by using their own ad server keep 100% of their revenue. Roku reserves the right to serve ads from the Roku Audience Network against 30% of the channel's ad inventory and keep 100% of the revenue from that share of ad inventory.

If one of your ad tags fails or returns empty, or if you are otherwise unable to fill all ad inventory from your channel, Roku may participate as an advertising demand partner on a revenue share basis.

How to make an ad selection

Before you can select between the two ad monetization options, you'll need to enroll in the Roku Partner Payouts Program (https://developer.roku.com/developer/billing). Once enrolled, navigate to the Monetization page and choose your preferred ad option. You can also select a Nielsen genre for more relevant ad curation.

(**Note:** The Partner Payouts Program was previously known as Roku Billing.

Developers already enrolled through Roku Billing do not need to re-enroll.)

Adding mid-roll ads

By default, channels built using Direct Publisher will display pre-roll ads. This should be sufficient for short-form videos. For other media types — such as movies or episodes — a publisher may want to optimize their content by adding mid-roll ads.

The timing for mid-roll ads is determined by inserting the optional "adBreaks" field into the content objects of your Direct Publisher channel feeds. Note that the "adBreaks" field is only available in JSON feeds, so publishers with any sort of long-form content should be sure to build their channel according to our JSON specifications (https://github.com/rokudev/feed-specifications/blob/master/direct-publisher-feed-specification.md).

Below is an example of a content object configured to include a mid-roll ad every 14 minutes:

```
content:

{

    dateAdded: "2015-11-05T14:14:54.431Z",

    captions: [  ],

    duration: 3150,

    adBreaks:

    [

        "00:14:00",

        "00:28:00",

        "00:42:00"

    ],

    videos:

    [

        {

            url: "https://example.org/cdn/videos/1509428502952.mp4",

            quality: "HD",

            videoType: "MP4"

        }

    ]
```

```
    }
```

Ad logic

Ad frequency rules

Before inserting adBreaks into your feed, it helps to understand the logic that determines how frequently ads are shown on a Direct Publisher channel.

When a viewer installs the channel, the first 15 minutes of content will be ad-free. After watching their first 15 minutes of content, they receive a pre-roll ad pod for every 7 minutes of content watched, in addition to an ad pod at each adBreak timestamp.

Pre-roll ad pods will never be longer than 30 seconds, and mid-roll pods will not exceed 90 seconds.

Determining mid-roll break points

It is up to the publisher's discretion how many mid-roll ads they'd like to serve against their content and when they should be shown. Generally, there are two approaches to inserting adBreaks:

1. **During scene transitions:** The best user experience for mid-roll ads occurs when ads are displayed during natural breaks in tension, such as during scene transitions, breaks in dialogue, or lulls in action. If adBreak metadata is not already available, this may require an "editor" to review the content and determine points in the content that lend themselves well to adBreaks.
2. **At regularly-scheduled intervals:** Publishers who don't have the resources to insert adBreaks during natural breakpoints may choose to insert adBreaks at regular intervals. Some publishers choose to show an ad every seven minutes (so as to maximize our ad frequency rules), while others space ads out every 10 or 15 minutes. Note that this approach can create jarring experiences for the viewer, such as cutting to an ad while a character is mid-sentence or in the middle of a high-stakes car chase.

Ad reporting

Roku can set up a report that will be emailed to you including daily impression activity for all of your channels. In order to receive impression statistics please email publisheradservices@roku.com (mailto:publisheradservices@roku.com) with your name, a list of all of the public advertising enabled channels you own, the email(s) to receive reporting and the frequency of reporting (daily, weekly or monthly).

Additional resources:

- Direct Publisher overview: developer.roku.com/publish (https://developer.roku.com/publish)
- Direct Publisher feed specifications (JSON): github.com/rokudev/feed-specifications/blob/master/direct-publisher-feed-specification.md (http://github.com/rokudev/feed-specifications/blob/master/direct-publisher-feed-specification.md)
- Roku advertising FAQ: developer.roku.com/develop/monetization/payments (https://developer.roku.com/develop/monetization/payments)
- Partner Payouts Program enrollment: developer.roku.com/developer/billing (http://developer.roku.com/developer/billing)

Tags: ads (/tag/ads), Direct Publisher (/tag/direct-publisher), Roku ads (/tag/roku-ads), roku audience network (/tag/roku-audience-network)

Links

- Developer Forums (https://forums.roku.com/viewforum.php?f=34)
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(//www.facebook.com/rokuplayer.instagram.com/rokuplay

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United States (change) ›

Exhibit K

ROKU (https://www.roku.com) Developers (https://developer.roku.com/ove

Uncategorized (/developer/category/uncategorized)

New web tools for faster development on Roku

tcharles - Dec 18th, 2016

(https://blog.roku.com/developer/files/2016/12/deep-linking-screenshot.png)

The Developer Dashboard contains many tools to help build beautiful, functioning Roku channels. In October, we added the ability to access crash logs and channel analytics (https://blog.roku.com/developer/2016/10/19/publishing-platform/). Now, we've introduced three web tools for speedier development, QA testing, and certification testing.

Sections:

- Stream Tester Tool
- Deep Linking Tester Tool
- Roku Remote Tool
- How to access the tools

Stream Tester Tool

(https://blog.roku.com/developer/files/2016/12/Screen-Shot-2016-12-13-at-8.29.49-AM.png)

Before you even begin development on your channel, you'll want to make sure the Roku platform supports your video content. To this end, developers can use our Stream Tester Tool (http://devtools.web.roku.com/stream_tester/html/index.html) to play video streams inside a private Roku channel. The tool also allows for DRM encodings or insertion of video ads from your own ad server.

To use the Stream Tester Tool, you must first install the associated private channel, using Vanity Code ZJMQ6D5 (https://my.roku.com/account/add?channel=ZJMQ6D5). Once installed, verify that your Roku box and computer are on the same network, then enter the IP address of your Roku box in the web tool. Specify whether you're testing a video stream or an ad, and fill in the necessary details: video format, encoding type, encoding key, etc.

(https://blog.roku.com/developer/files/2016/12/stream-tester-video-screenshot.png)

When you're finished, hit Go. If your stream is supported, it will launch within the Roku Stream Tester private channel you just installed on your Roku box. The video will be overlaid by metadata associated with the stream, such as the audio format or subtitle tracks.

Deep Linking Tester Tool

(https://blog.roku.com/developer/files/2016/12/deep-linking-screenshot.png)

All Roku channels with video content are required to support "deep linking" — the ability to launch directly into a piece of content from a display ad or Roku Search via our ECP protocol. The Deep Linking Tester Tool (http://devtools.web.roku.com/DeepLinkingTester/) makes it easy to create and send deep linking test suites that can be shared with developers and QA.

For this tool, start by entering the name and Channel ID of any channel you will want to build a deep link command for. Then, enter the contentID of the particular piece of content you will be linking to, along with the mediaType. You can find a list of all available mediaTypes in our deep linking documentation (https://sdkdocs.roku.com/display/sdkdoc/Deep+Linking). You can also enter additional arguments in the key-value fields.

As you enter each parameter, the tool creates a custom cURL command. When you're finished and hit "Send," that cURL command posts to the Roku box at the IP address you entered. If properly configured, the specified content item will launch. (Note that if the channel launches but the intended piece of content does *not* start to play then you have not properly configured your deep link command. You've simply entered the correct Channel ID.)

Once your test suites are working as you'd like, they can be exported as a JSON file for easily sharing with teammates.

(https://blog.roku.com/developer/files/2016/12/deep-linking-channel.jpg)
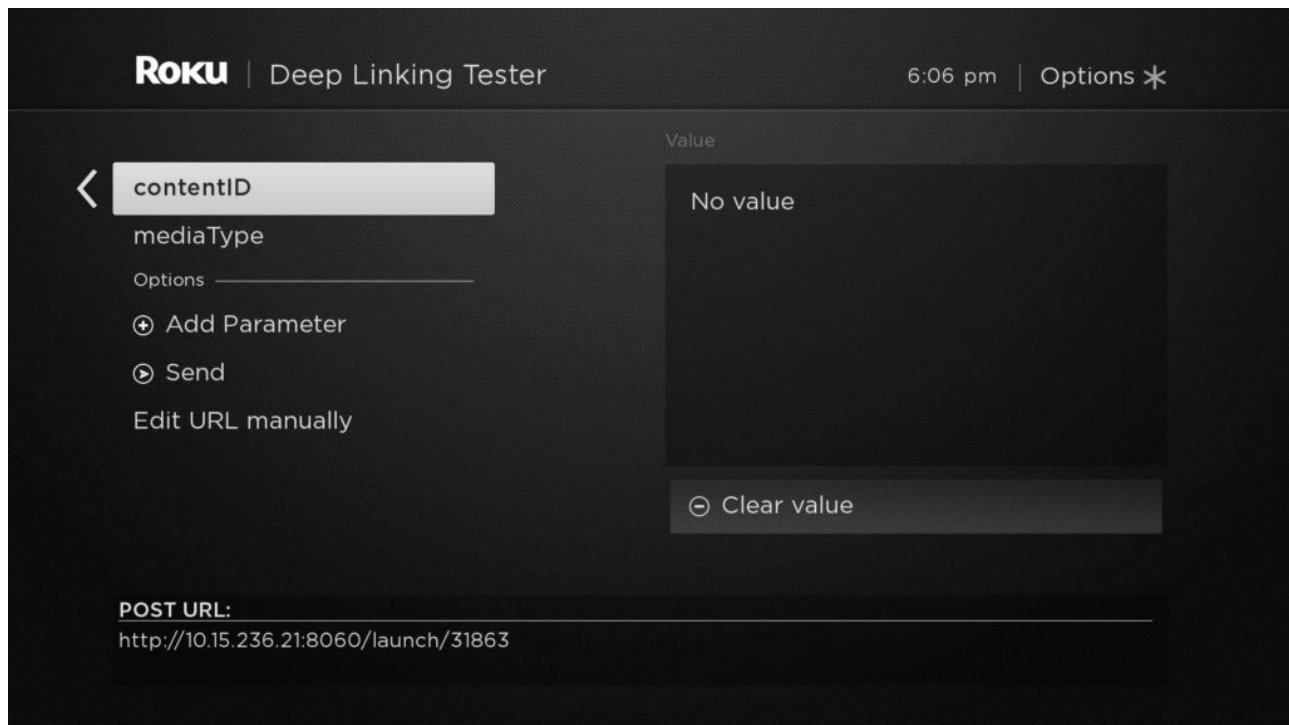
As with the Stream Tester Tool, the Deep Linking Tester Tool comes with a companion private channel, which can be installed at Vanity Code KX3UPK (https://my.roku.com/account/add?channel=KX3UPK). Use the companion channel for defining and running deep link commands directly on your Roku box.

See our SDK documentation for more information on deep linking. (https://sdkdocs.roku.com/display/sdkdoc/Deep+Linking)

Roku Remote Tool

(https://blog.roku.com/developer/files/2016/12/remote-tool.png)
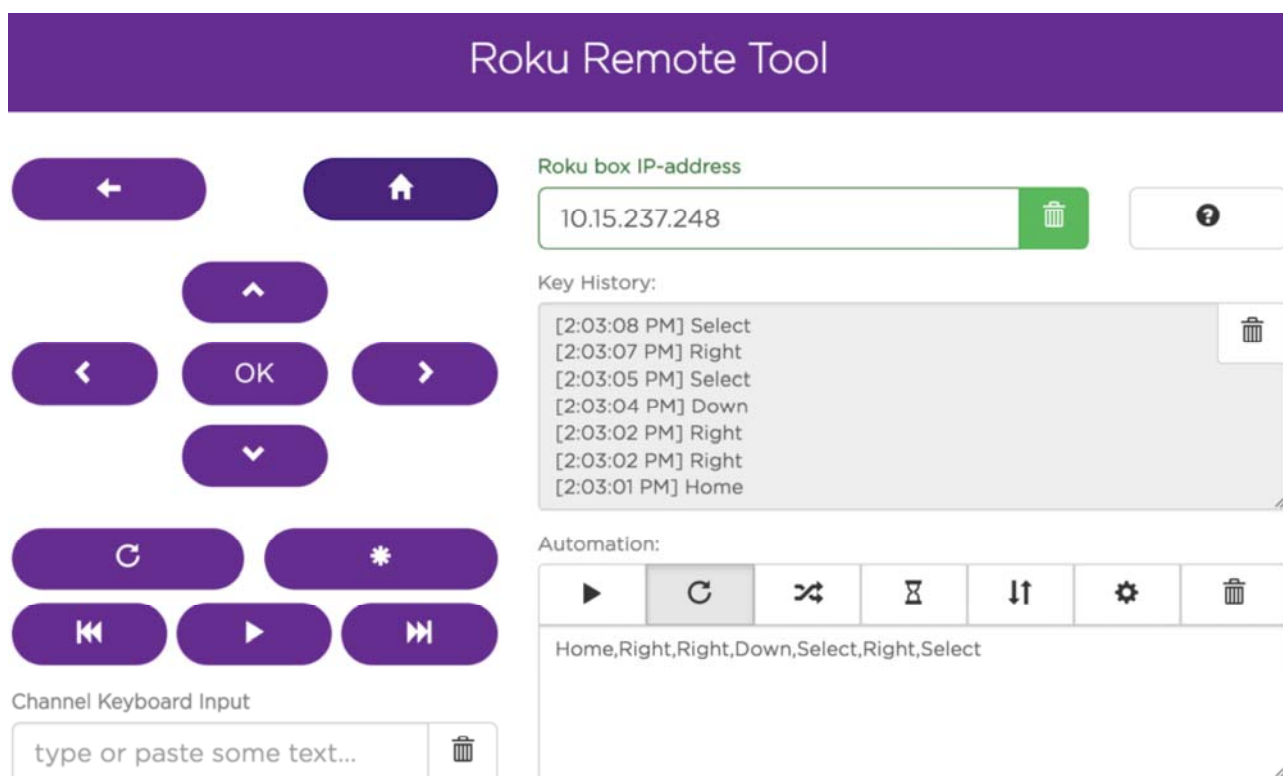
The Roku Remote Tool
(http://devtools.web.roku.com/RokuRemote/index.html) offers the same
functionality as a regular Roku remote, but from the convenience of a web
browser. In addition, it comes equipped with a keyboard input feature for quickly
filling out text screens. When used properly, this feature — along with the ability
to export and import keystrokes— can be used to speed up or even automate
parts of your regular channel QA testing.

How to access the tools

(https://blog.roku.com/developer/files/2016/12/dashboard.png)Linked to these tools can be found on the Developer Dashboard (https://developer.roku.com/developer) or our RokuDev GitHub account (https://github.com/rokudev/docs/tree/master/develop/developer-tools). Alternatively, developers can navigate directly to developer.roku.com/web/tools (https://developer.roku.com/web/tools).

Additional Resources:

- Roku Testing Tools page: developer.roku.com/web/tools (https://developer.roku.com/web/tools)
- Stream Tester Tool: devtools.web.roku.com/stream_tester/html/index.html (http://devtools.web.roku.com/stream_tester/html/index.html)
- Stream Tester private channel: my.roku.com/account/add?channel=ZJMQ6D5 (https://my.roku.com/account/add?channel=ZJMQ6D5)
- Deep Linking Testing Tool: devtools.web.roku.com/DeepLinkingTester/ (http://devtools.web.roku.com/DeepLinkingTester/)
- Deep Linking Tester private channel: my.roku.com/account/add?channel=KX3UPK (https://my.roku.com/account/add?channel=KX3UPK)
- Roku Remote Tool: devtools.web.roku.com/RokuRemote/index.html (http://devtools.web.roku.com/RokuRemote/index.html)
- Deep linking documentation: sdkdocs.roku.com/display/sdkdoc/Deep+Linking (https://sdkdocs.roku.com/display/sdkdoc/Deep+Linking)

Tags:

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- Developer Forums (https://forums.roku.com/viewforum.php?f=34)
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United States (change) ⟩

Exhibit L

(RokuRemote)

Roku Ecosystem Tools

Our goal is to provide you with the fastest tooling for building the Channels on every Roku device.

(DeepLinkingTester)

Code editing, debugging, designing, performance measuring and testing tools allow you to focus on building beautiful, unique and high-quality Roku Channels.

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

Remote Tool (RokuRemote)

Version 3.0.17 (what's new)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)

Tired of finding the right remote while testing your channel? Entering text into input screens in your channel slowing down development? Navigate your Roku and channel, send a text to keyboard screens, and much more with the Roku Remote Tool. You can even write your own scripts, run them on a device as well as export or import them later for simple automation needs.

Main features:

▷ Virtual remote control

▷ Automation

▷ Extended standalone application

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)
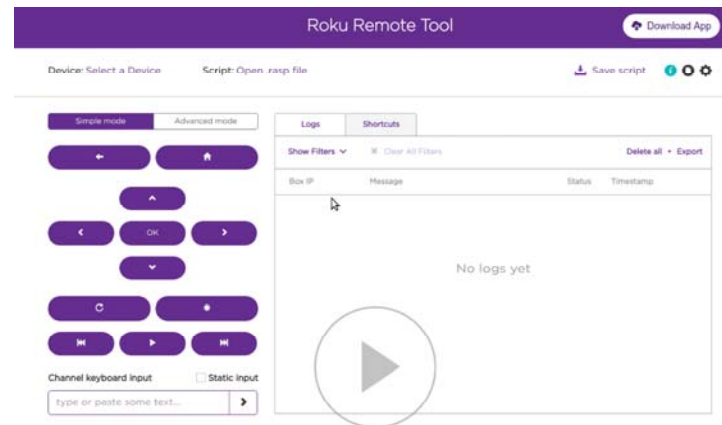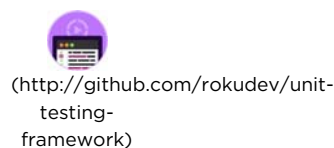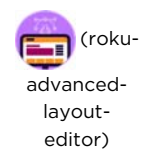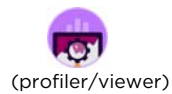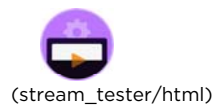
Launch (RokuRemote)

Deep Linking Tester (DeepLinkingTester)

Version 2.3.1 (what's new)

Deep linking is a Roku channel certification requirement for readying your channel to support Roku Search or to work with banner ads. This web utility and companion channel make it very easy to send deep linking commands to your channel and to build deep linking test suites that can be shared with developers and QA.

Main features:

Visual Deep Linking Viewer / Editor

Multiple Test Channels / Test Cases

Import / Export

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)
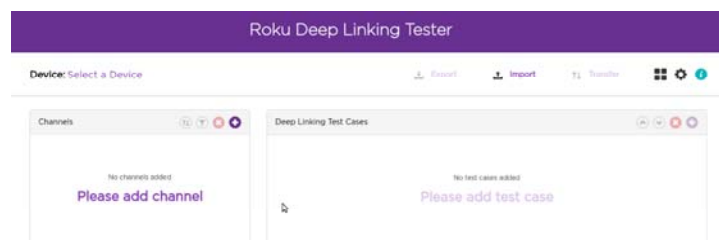
Launch (DeepLinkingTester)

Stream Tester (stream_tester/html)

Version 1.6.4 (what's new)

See how your video content looks on Roku before writing a single line of code. This utility lets you play content in our video stream test channel from the convenience of a web browser. As an added bonus, you can test your video ads, and even see how they will look when inserted into your video content.

Main features:

▷ Video / Audio testing

▷ RAF Ads testing

▷ Configurable Meta-Data
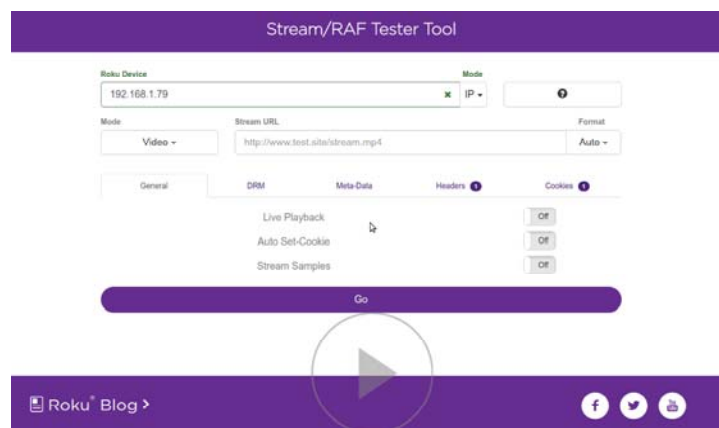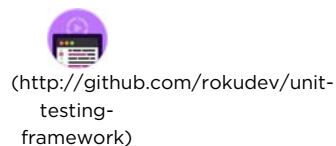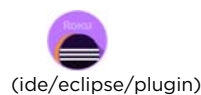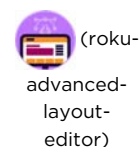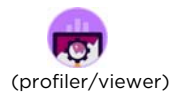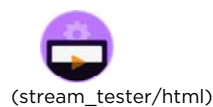
Launch (stream_tester/html)

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)

BrightScript Profiler Visualization Tool (profiler/viewer)

Version 2.2.4 (what's new)

The BrightScript Profiler gathers important metrics such as CPU usage, "wall-clock" time, etc. In addition to that it gives you memory profiling and leak detection. Use this tool to analyze where performance improvements and efficiencies can be made in your channel

Main features:

▷ Table-tree view for CPU and Memory data

▷ Memory Graph

▷ Memory operations and leak detection

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomic-package)

(http://github.com/rokudev/unit-testing-framework)
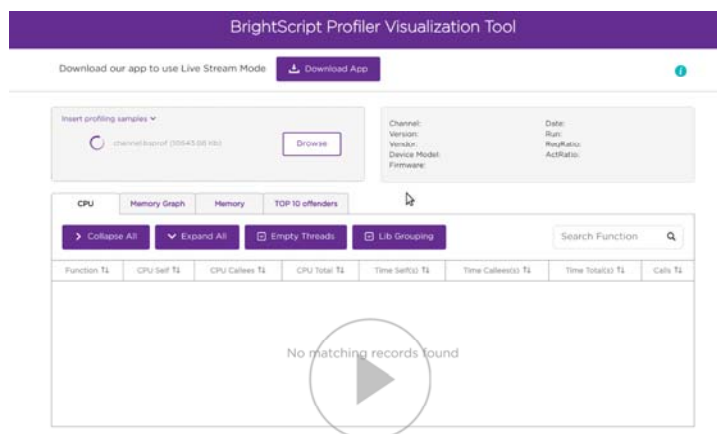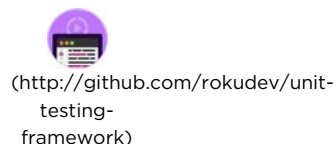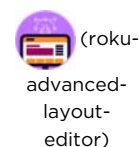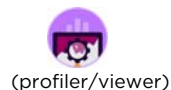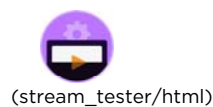
Launch (profiler/viewer)

Advanced Layout Editor (roku-advanced-layout-editor)

Version 1.7.8 (what's new)

The Roku Advanced Layout Editor, aka RALE, is a tool that provides a hierarchical view of the node tree in a Roku Scene Graph channel. It also lets developers or designers dynamically lay out the visual aspects of a channel for quick prototyping and design purposes. Changes are made in the RALE UI and reflected immediately on the channel under test on the target Roku device.

Main features:

Predefined channel templates

Component editing on the fly

Live Layout viewer / editor

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-
advanced-
layout-
editor)

Roku Advanced Layout Editor v.1.3.8   Device: Select Device

Please Set Device
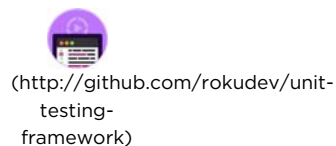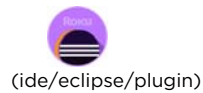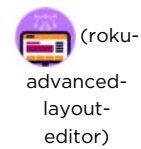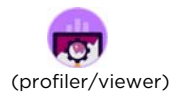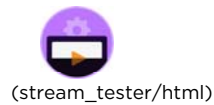
Launch (roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-
package)

Eclipse Plugin (ide/eclipse/plugin)

Version 1.3.0 (what's new)

(http://github.com/rokudev/atomio-
package)

(http://github.com/rokudev/unit-
testing-
framework)

The Eclipse IDE (Integrated Development Environment) is used by millions of professional engineers around the world for coding and deploying rich applications. With Roku plugin channel developer would get an excellent and native support for BrightScript and RSG out of the box!

Main features:

▷ Channel template wizard

▷ Deploy Channel to the device

▷ Code autocomplete
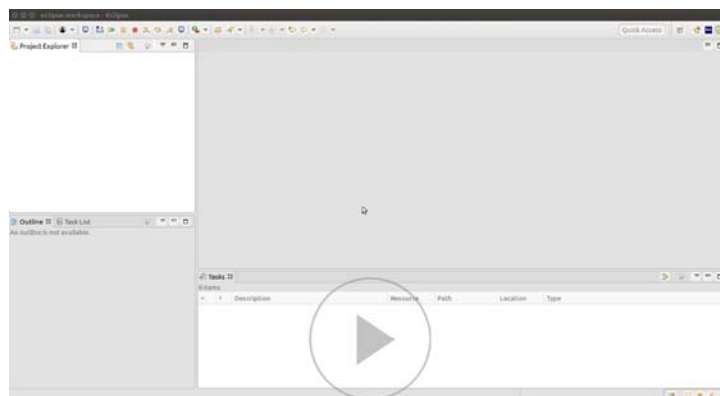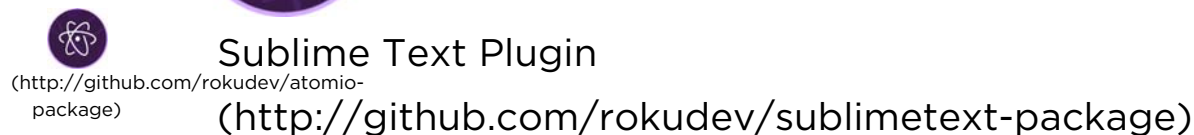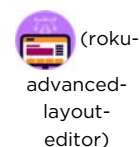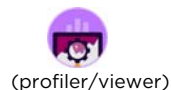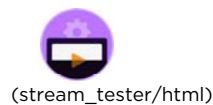
Launch (ide/eclipse/plugin)

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

Sublime Text Plugin
(http://github.com/rokudev/sublimetext-package)

Version 1.0.1 (what's new)

(http://github.com/rokudev/unit-testing-framework)

Sophisticated text editor for code, markup and prose. You will love the slick user interface, extraordinary features and amazing performance that are now extended with Roku BrightScript and Roku Scene Graph support.

Main features:

▷ Basic language operations: foreach, if statement

▷ Global functions autocomplete

▷ Deploy channel to the device

```
31      resultColor = resultColor + "00"
32      ····else
33      ········resultColor = resultColor + "FF"
34      ····end if
35      ····
36      ····m.color = resultColor
37      ····m.rectangle.color = resultColor
38
39      ····
40      end sub
41
42
43      function formTitlesForNextScreen(currentColor as String) as Object
44      ····titles = []
45      ····for each color in m.baseColors
46      ········if instr(1, currentColor, color) = 0
47      ············titles.Push(currentColor + " " + color)
48      ········end if
49      ····end for
```

Launch (http://github.com/rokudev/sublimetext-package)

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)

Atom.io Plugin (http://github.com/rokudev/atomio-package)

Version 1.0.0 (what's new)

A hackable text editor for the 21st Century, now with Roku Brightscript and Scene Graph flavor!

Main features:

Syntax highlighting, Deploy, etc.

Foreach autocomplete

Global functions autocomplete

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atom-package)

(http://github.com/rokudev/unit-testing-framework)

Launch (http://github.com/rokudev/atomio-package)
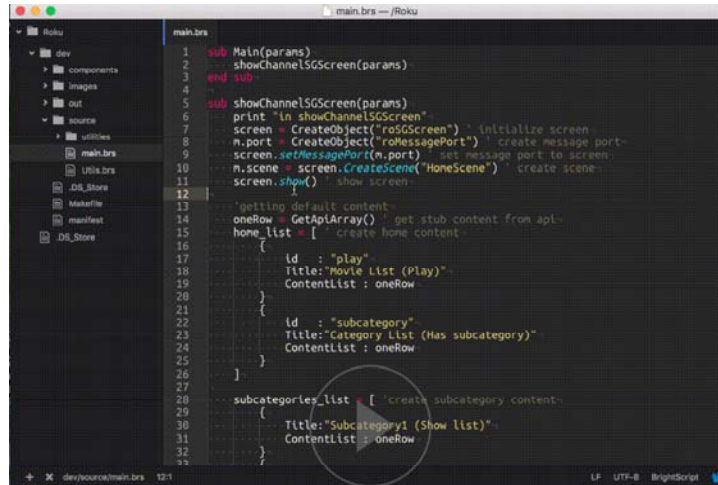
Unit Test Framework (http://github.com/rokudev/unit-testing-framework)

Version 2.0.1 (what's new)

A simple and powerful framework that enhances Roku Channel development process and provides tooling for high-quality assurance of a channel via unit-tests methodologies.

Main features:

▷ Write and Run unit tests

▷ Verify / Report

▷ Basic / Advanced asserts

Launch (http://github.com/rokudev/unit-testing-framework)

(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

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Roku

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(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)

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See what's on (https://www.roku.com/what on)	Roku players (https://www.roku.com/prod	Before you buy (https://support.roku.com/cat -before-you-buy)	Newsroom (http://newsroom.roku.com/)	Advertise with us (https://www.roku.com/roku advertising)
The Roku Channel (https://www.roku.com/show roku-channel)	Accessories (https://www.roku.com/acce	How to: Using your Roku (https://support.roku.com/cat -getting-started)	Investor relations (https://ir.roku.com)	Affiliate program (https://www.roku.com/abou
Link your Roku device (https://my.roku.com/link)	Special offers (https://www.roku.com/offer	Account and billing (https://support.roku.com/cat -account-and-billing)	Jobs (https://www.roku.com/abou	Become a beta tester (https://www.roku.com/beta
Create a Roku account (https://my.roku.com/signup	Mobile app (https://www.roku.com/mob app)	Setup and troubleshooting (https://support.roku.com/cat -troubleshooting)	Accessibility (https://www.roku.com/acce	Service providers (https://www.roku.com/roku powered)
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(RokuRemote)

(DeepLinkingTester)

(stream_tester/html)

(profiler/viewer)

(roku-advanced-layout-editor)

(ide/eclipse/plugin)

(http://github.com/rokudev/sublimetext-package)

(http://github.com/rokudev/atomio-package)

(http://github.com/rokudev/unit-testing-framework)

Exhibit M

(https://www.roku.com)

How it works
(https://www.roku.com/how-it-works)

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Products

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(https://www

Roku Advanced Layout Editor

Standalone Application

The Roku Advanced Layout Editor, aka RALE, is a tool that provides a hierarchical view of the node tree in a Roku Scene Graph channel. It also lets developers or designers dynamically lay out the visual aspects of a channel for quick prototyping and design purposes. Changes are made in the RALE UI and reflected immediately on the channel under test on the target Roku device.

Main features:

- Predefined channel templates
- Component editing on the fly
- Live Layout viewer / editor

Download Standalone App for your OS

Mac OS - 64 bit

(/roku-advanced-layout-editor/mac.html)

Windows - 64 bit

(/roku-advanced-layout-editor/win.html)

32 bit version (/roku-advanced-layout-editor/win.html?bit=x32)

Linux - 64 bit

(/roku-advanced-layout-editor/linux.html)

32 bit version (/roku-advanced-layout-editor/linux.html?bit=x32)

RALE component

(app/TrackerTask.zip)

Stay updated on news and offers (optional)

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See what's on (https://www.roku.com/whats-on)	Roku players (https://www.roku.com/produ	Before you buy (https://support.roku.com/cat-before-you-buy)	Newsroom (http://newsroom.roku.com/)	Advertise with us (https://www.roku.com/roku-advertising)
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Exhibit N

Roku SDK Documentation / Roku SDK Documentation / Developer Tools

Roku Advanced Layout Editor

The Roku Advanced Layout Editor (RALE) is a tool that lets developers or designers dynamically layout the UI elements of a channel for quick prototyping and design purposes. Changes made in the tool's editor are reflected real-time in a demonstration channel on a local Roku device.

RALE also provides a hierarchical view of a channel's Roku Scene Graph (RSG) node tree, making it very easy for the developer to visualize the parent-child relationships between nodes.

To begin using RALE, visit our developer tools page.

Below is a list of some of the features available in RALE.

Predefined Channel Templates

By default, RALE offers some predefined channel templates to help the designer get started. These templates can be used as pre-built channels, or simply as a starting point for the designer to customize further.
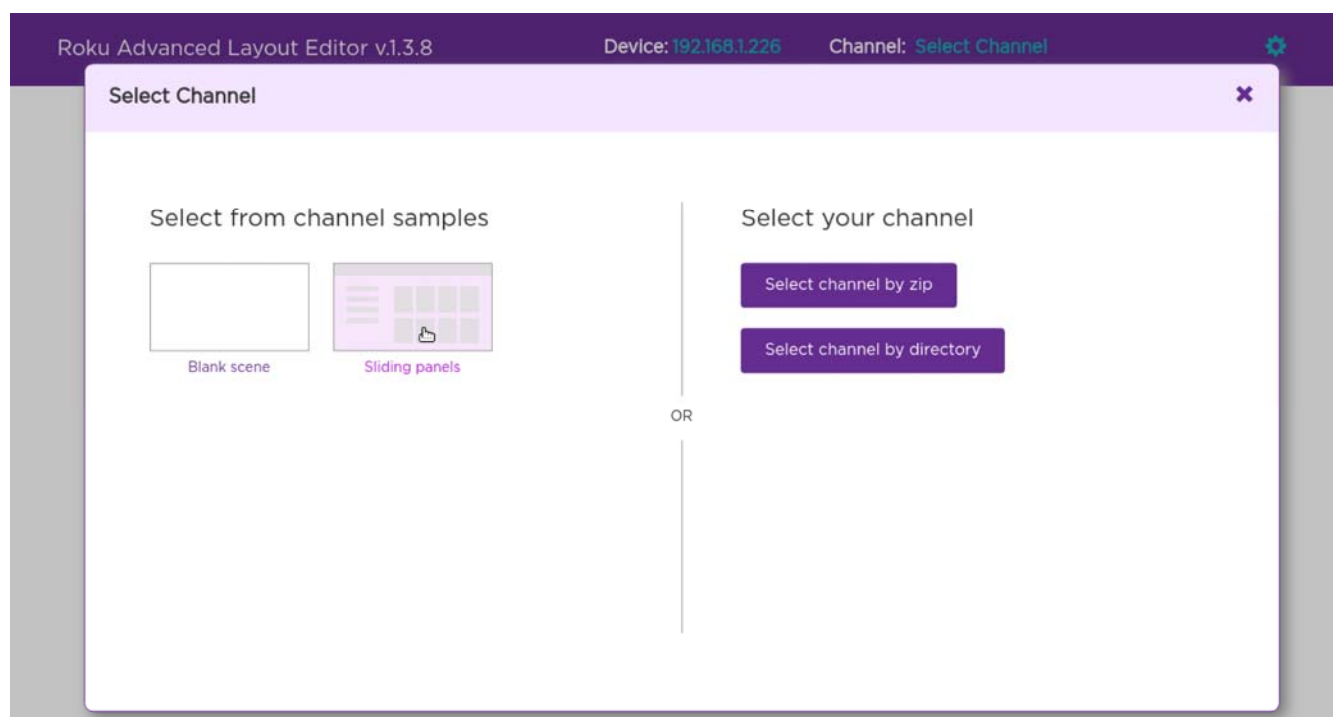
Real-Time Layout Viewer

RALE adds the option to see your design in a GUI view and see your edits reflected instantly. This feature eliminates the need to re-deploy your application to review minor channel changes.
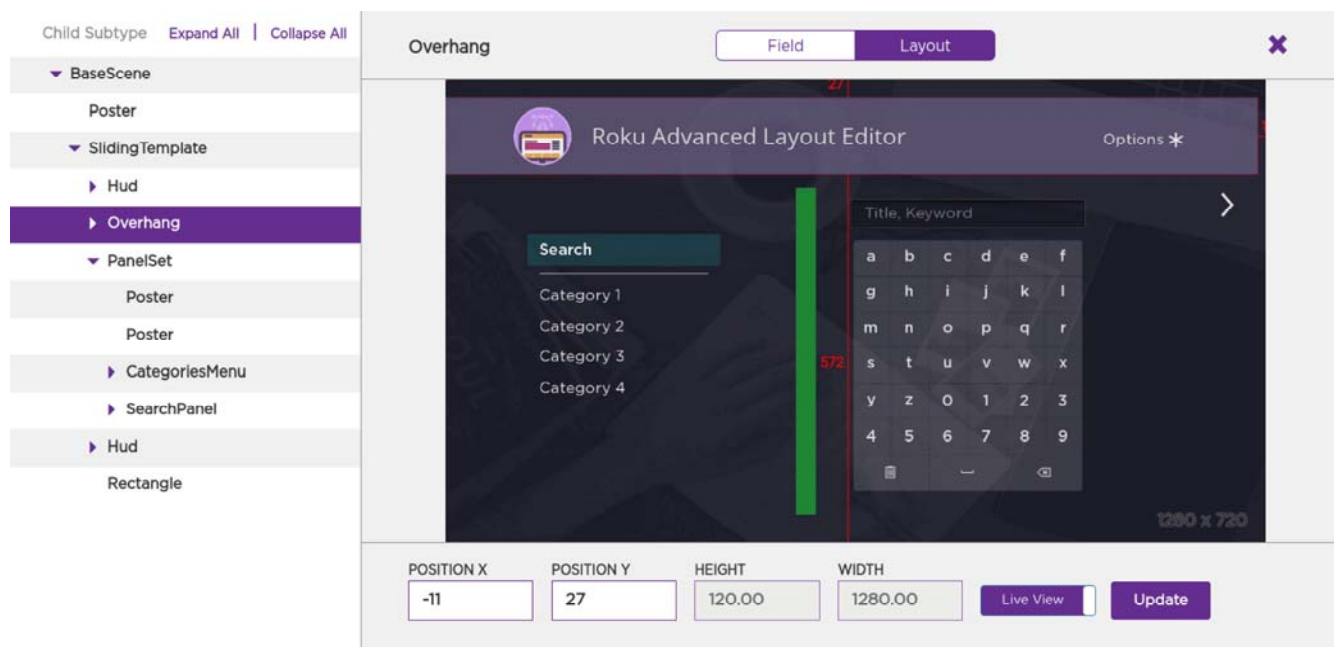
Node Tree Editor

RALE provides an editable, visual view of the RSG node hierarchy of the channel under development. This view lets the developer drill down into the parent-child relationships of the nodes that make up the channel. All node fields can edit in real time, and these changes are reflected immediately in the running channel.
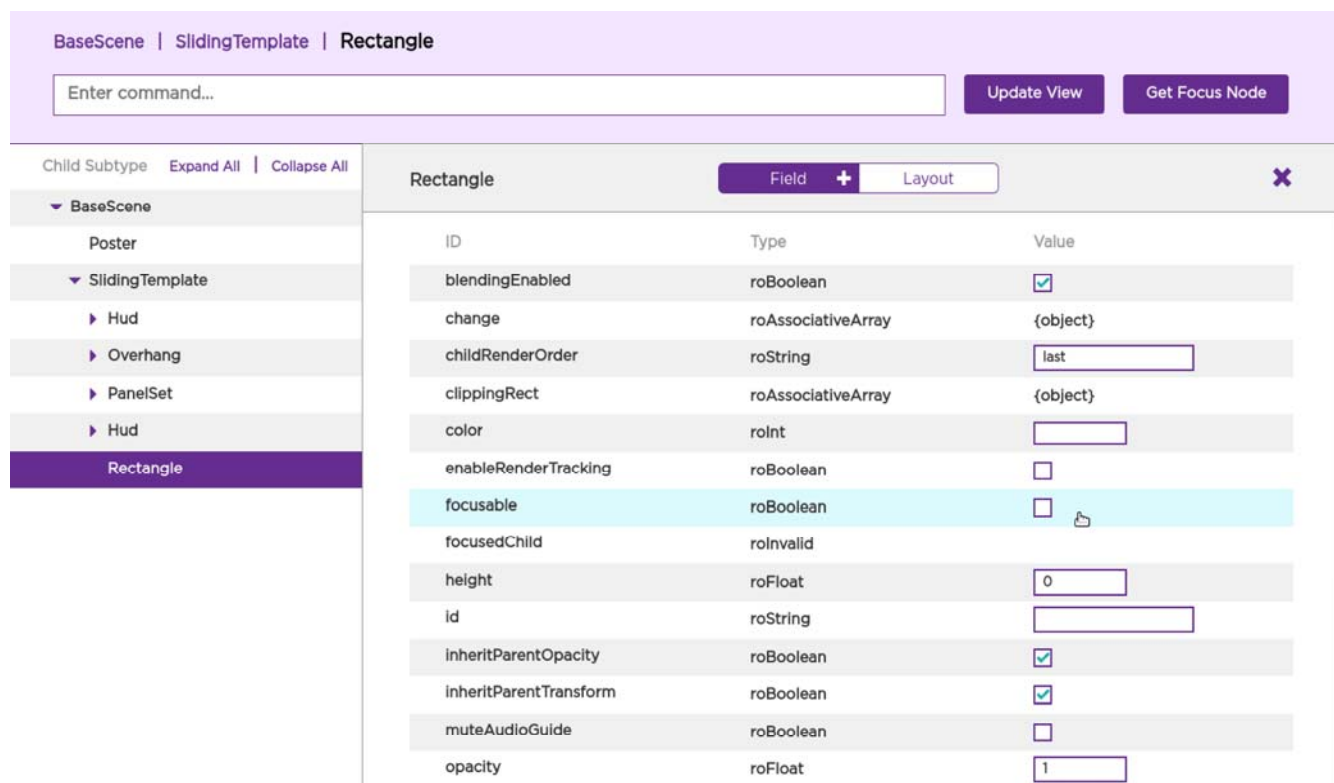
Accessing RALE

Install RALE to begin incorporating the tool into your design and development workflow.

Exhibit O

Roku SDK Documentation / ... / Publishing Roku Channels

Create a Non-Certified Channel

Table of Contents

Overview of Non-Certified Channels

Non-certified channels are another way to distribute channels on the Roku platform. They are not listed in the Channel Store and can only be installed using the channel access and/or vanity code(s). Non-certified channels are not subject to the channel certification process. See Non-Certified Channels.

Contact advertising@roku.com for more details.

Prerequisites and Guidelines for Creating a Non-Certified Channel

To assure success in creating a Non-Certified Channel, you will need to:

1. Create your design assets following Design and User Experience Guidelines.
2. Go through the Channel Certification.
3. Package your Roku Channel.
4. Publish your Channel (this page).

Create a Non-Certified Channel
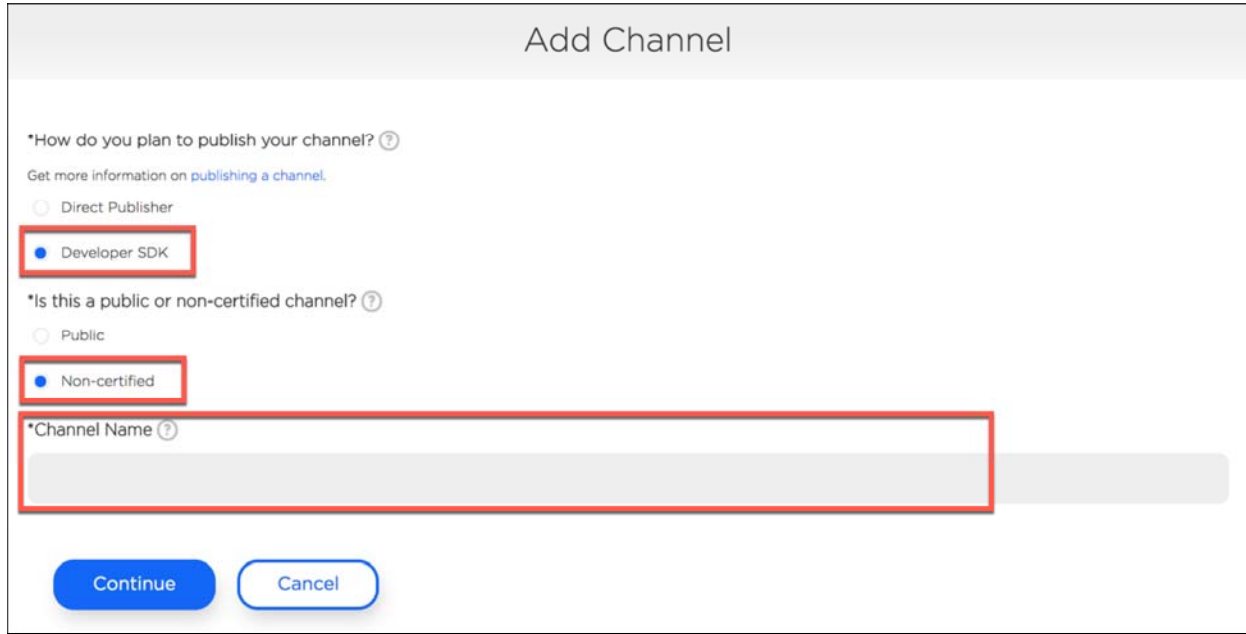
On the **Developer Dashboard**, select **Manage My Channels** and **Add Channel** on the following page.

Add Channel Window

From the radio buttons, select **Developer SDK**, and **Non-certified**, and then enter a **Channel Name** in the field.

Properties Window

In the *properties* window, all default values are pre-selected. Modify as needed.

non-certified channel / Properties

Manage My Channels ˅ | Properties ˅   Preview

The channel properties associated with your unpublished package will be seen in the Channel Store when the package is published.

Please provide the following Channel Store information for your channel.

*Channel Stores ?

☑ United States

○ Canada

○ France

○ Ireland

○ Mexico

○ Rest of World

○ United Kingdom

○ jp

○ nz

*Languages ?

☑ English

○ French

○ Japanese

○ Spanish

Required Features ?

○ USB Support

○ Sugarland, Roku 2, 3 & 4

○ Roku 3 +

○ Screensaver

○ Paolo Plus

○ TestAustinOwnerVisible

○ ENStreaming Stick

○ USB Support - Package

○ Roku Enhanced Remote

○ iiii

○ abcd

○ testFix

*Classification ?

Video   ˅

*Internet Connection Required ?

● Yes

○ No

*Does this channel have accessibility features that make it compliant with the Twenty-First Century Communications and Video Accessibility Act (CVAA)? ?

○ Yes

● No

*Parental Hint ?

All Ages   ˅

Vanity Access Code

C62ZRP2

Once published, your channel can be added to a Roku account using:
https://my.qa.roku.com/add/C62ZRP2

[Save]   (Cancel)

Channel Store Info Window

Edit the channel's **Description** as needed, upload a **Channel Store poster** (540x405), select a **Preferred Category**, and click **Save**.

Monetization Window

In the *Monetization* window, select how you plan to monetize your channel and click **Save**.

Package Upload Window

Upload your signed package and click **Save**.

Preview and Publish Window

Review details in the *Preview and Publish* window, and select **Submit for Publishing** when done.

Exhibit P

Roku SDK Documentation / ... / Publishing Roku Channels

Create a Public Channel

Table of Contents

Overview of Public Channels

Channels in the Roku Channel Store are certified before they are made available to the public. Some of the key benefits for public channels are:

- Featured in the New category for 30 days after publication
- Displayed in a Channel Store category (chosen during the submission process)
- Searchable by channel name in Roku Search

Channels with deep linking and have submitted a Roku Search feed can also support:

- Home screen banner promotions[1]
- Roku Search by content or person(s)

Prerequisites and Guidelines for Creating a Public Channel

To assure success in creating a Public Channel, you will need to:

1. Create your design assets following Design and User Experience Guidelines.
2. Go through the Channel Certification.
3. Package your Roku Channel.
4. Publish your Channel (this page).

Create a Public Channel

1. On the **Developer Dashboard**, select **Manage My Channels** and **Add Channel** on the following page.

2. Next, select **Developer SDK**, **Public**, enter a **Channel Name** and click **Continue.**

Properties Window

Fill out the following properties:

- **Channel Stores**: regions the channel will be available in
- **Languages**: Languages to localize the Channel Store poster, descriptions and screenshots for
- **Required Features**:
    - USB Support: Select this only if the channel requires a Roku with a USB port to function
    - Screensaver: Select this only if the channel is/contains a screensaver
    - Roku Game Remote: Select this only if the channel requires a remote with A & B buttons to function
- **Classification**: Select the option that best describes the channel type
- **Internet Connection Required**: Yes/No
- **CVAA Compliance**: Yes/No
- **Parental Hint**: Select the best rating for the content in the channel. If unsure, select Content Not Rated.
- **Vanity Access Code**: Add a unique string of characters to make sharing the channel easier (ex. https://my.roku.com/add/myrokuchannel). The Vanity access code is only available after a channel has been published.

Channel Store Info Window

On the **Channel Store Info** page:

- Add **Description**
- Choose **Preferred Category** (Channel Store category for each region in the drop-down menu)
- Upload the Channel Store Poster (540x405).

> ⚠ If multiple languages were selected on the Channel Properties page, the Channel Descriptions page will have a separate section for each language for locale-specific descriptions and Channel Store icons.

Monetization Window

On the **Monetization** page, select how you plan to monetize your channel. If your channel contains ads, it must use the Roku Ad Framework.

> ⚠ Monetizing by way of ads requires enrollment in Roku Billing Services as you'll receive a revenue share from ads backfilled by Roku.

Public Channel / Monetization

Manage My Channels ˅ | Monetization ˅   Preview

How do you plan to monetize your content? Please select all that apply.

○ My channel contains ads.

○ Customers will pay before installing my channel.

○ My channel contains in-channel subscriptions.

○ My channel contains in-channel one-time purchases.

○ My channel requires a cable or satellite subscription.

☑ None of the above apply. I will not be monetizing my channel.

[Continue]   (Cancel)

If **Customers will pay before installing my channel** is selected and you've enrolled in the Roku Partner Payouts Program, the **Pricing** section will be presented below.

Public Channel / Monetization

Manage My Channels ˅ | Monetization ˅   Preview

How do you plan to monetize your content? Please select all that apply.

○ My channel contains ads.

☑ Customers will pay before installing my channel.

○ My channel contains in-channel subscriptions.

○ My channel contains in-channel one-time purchases.

○ My channel requires a cable or satellite subscription.

○ None of the above apply. I will not be monetizing my channel.

Pricing

The following pricing information will be used for your channel.

Please note: All transactions on this channel will be treated as 'test transaction' until you enroll in Roku Billing Services. The user's payment method will not be charged.

*Purchase Type ⓘ

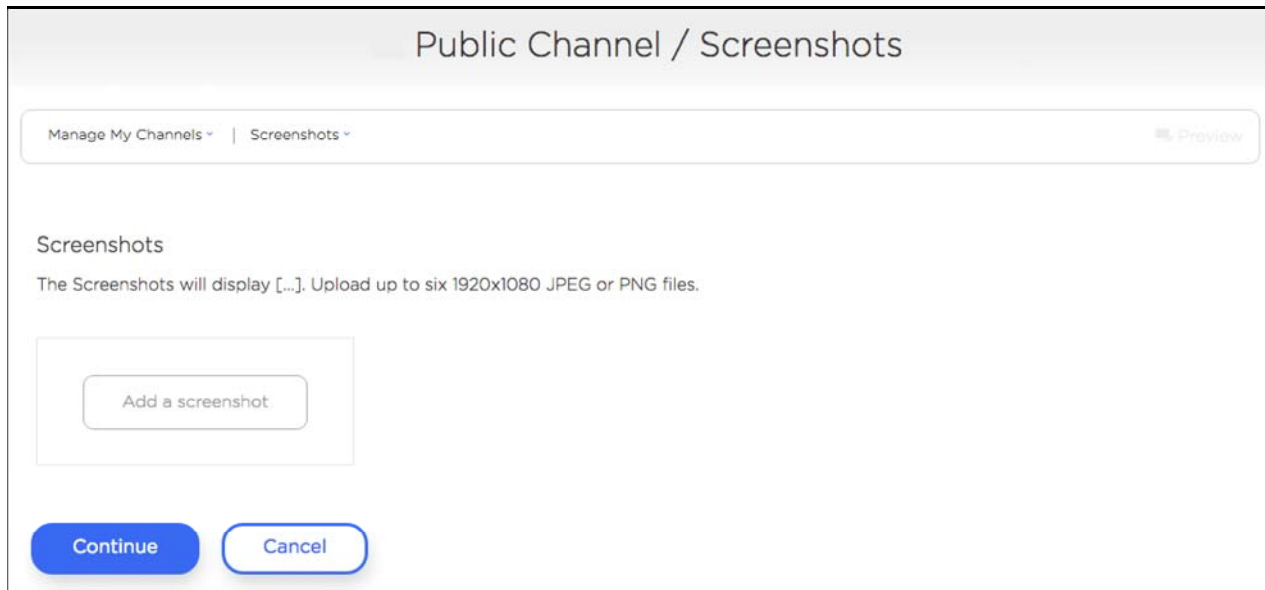| None (Free) | ˅ |

*Price Tier ⓘ

| Price Tier 0 | ˅ |

[Continue]   (Cancel)

In this section, the type of pay-to-install model (one-time, monthly subscription or yearly subscription) and a corresponding price tier can be selected.

Screenshots Window

On the next page, upload any screenshots for display in the Channel Store. Up to 6 FHD (1920x1080) images can be uploaded for each locale.

> ⚠ Note: Refer to the Screenshots section under the Developer Settings page for instructions on taking channel screenshots.

Once the screenshots have been uploaded, select Continue.

Support Information Window

Fill out the required contact and support information and any test accounts as needed for Roku to review your submission.

Package Upload Window

On the **Package Upload** page, select:

- Channel Version
- Minimum firmware version required to run the channel
- Application Package: Select signed package for publication

and then click `Continue`.

Preview and Publish Window

Before selecting `Publish` to submit for Roku certification review, you can select the `access code` to add the channel to your device and also make sure it has been thoroughly tested and reviewed against the **pre-certification channel checklist**.

Submission Survey Window

When ready, select `Publish` and fill in any **Release Notes** and **Key Dates** as necessary.

Submission Survey

Manage My Channels ˅ | Submission Survey ˄   Preview

Channel Version 1.0 Submission Survey

*Release Notes ⑦

1500 characters remaining

Key Dates ⑦

300 characters remaining

○ I confirm that I have tested my channel against the Roku Channel Publishing Checklist and confirm that my channel passes all applicable tests. I understand that should my channel fail any applicable test, the submission may be rejected and the publication delayed. I also confirm that my channel adheres to the requirements of the current versions of the Roku SDK License Agreement and Roku Application Distribution Agreement and that my channel submission may be declined for any reason in accordance with these agreements.

Continue   Cancel

*These fields are required

Select `Continue` to complete your submission and return to the **Preview and Publish** page.

Public Channel / Preview and Publish

Manage My Channels ˅ | Preview and Publish ˅   Preview

Channel Summary

- Channel Name:
- Visibility: Public
- Date Created: 10/14/2016
- Date Modified: 10/14/2016

- Vanity Access Code:
- Parental Hint: All Ages
- Additional Requirements: None
- Purchase Type: None (Free)
- Price Tier: 0

Preview

We recommend previewing your channel on your Roku box. You may also allow others to preview your channel before you publish.

ROKU Developers

- Access Code:
- Date Created: 10/14/2016
- Date Modified: 10/14/2016
- Status: Publishing
- Version: 1.0
- Min. Firmware: v7.20 b2
- Description: A Public Channel
- Package File: Download

Publishing Channel

Your channel has been submitted for publishing and is being reviewed.

✓ Properties
✓ Channel Store Info
✓ Monetization
✓ Package Upload
✓ Support Information

Status: Publishing

Access Code:

Version: 1.0

Cancel Submission

Once the channel has been submitted, it will be reviewed by Roku and:

- published if it has passed certification
- or you will receive a list of issues that need to be addressed before publication